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VENTILATION AND AIR-CONDITIONING SYSTEM

Description and Maintenance Instructions

[redacted]

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I. DESCRIPTION

A. PURPOSE AND MAIN TECHNICAL DATA

1. PURPOSE

The ventilation and air-conditioning system of the ship is designed for:

(a) ventilation of the submarine's spaces when she is on surface or snorkeling, with air cooling in compartments I, II, III and IV;

(b) ventilation of storage battery wells on surface and when snorkeling;

(c) cooling of air in compartments and spaces when the submarine is on surface or submerged by means of individual coolers located in each compartment;

(d) purification of air in battery wells, galley, lavatories, shower and electric torpedoes from noxious admixtures when submerged.

Moreover, the ventilation system may be used:

(e) to ventilate a group of compartments or one compartment to the weather during electric welding;

(f) to agitate air between compartments;

(g) to test the pressure hull for tightness.

System fittings are: ventilators, throttle valves, swivel air distributors, strainers made of aluminium-magnesium alloy, bulkhead gate valves and steel straight-way ventilation flappers mounted on the battery wells pipe line and on cross-connection in compartment V.

All fittings are made of steel.

The ship's pipe line and its fittings have anticorrosion coatings.

Shock absorbers and shock-absorbing branch pipes are manufactured of rubber.

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2. MAIN TECHNICAL DATA

The technical data of the venting system pipe lines and equipment are set forth in Tables 1 - 5.

Ventilation Duct Technical Data

Table 1

Nos	Description	Pipe dimensions (external diameter X wall thickness), mm	Type of material pipes are made of	Type of connections and gasket material	Tests		Remarks
					for strength, in the shop, by water, kg/sq.cm	for tightness, in assembly, kg/sq.cm	
1	2	3	4	5	6	7	8
1	Ventilation pipes Right-angled pipes and pipes of adapter sections	406-156x1.5 131-56x1	Aluminium-magnesium alloy	Flange connection with rubber gaskets	By filling with water	By excessive air pressure equal to the head of blower	
2	Pipes passing	156/106x1	Stainless	Flange con-			

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1	2	3	4	5	6	7	8
2	Pipes passing from the strainer 4MT-200P to air cooler	156/106x1	Stainless steel	Flange connection with paronite gaskets			
3	Outlet pipes from electric blowers	24x2	Copper	Pipe union with paronite gaskets	By filling with water	Are not tested	
4	Pipes to vacuum gauges	9x1.5	Copper				

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Table 2

Nos	Electric blower index	Rated air input capacity, m^3/hr	Nominal head of electric blower, mm H_2O	Consumed power, kW	Number of electric blowers	Place of installation (compartments)
1	[illegible]	10000	380	18.2	2	V
2	[illegible]-11	3000	110	2.68	4	II,IV,VI,VII
3	[illegible]-11	1500	110	1.33	2	III,VII
4	[illegible]-12	800	170	1.21	3	II,IV
5	[illegible]-4	300	240	0.468	1	V
6	[illegible]-12	300	170	0.496	4	I,IV
7	[illegible]-11	300	110	0.384	5	I,III,VI,VII

Note: The technical data of electric blowers are given for 220 V.

Technical Data of BOT-Q Type Mains Air Coolers and BOT-E Type Special Air Coolers

Table 3

Nos	Air cooler index	Rated air output, m^3/hr	Area of heat-exchange surface, sq.m	Heat load, Cal/hr	Number of air coolers in compartments	Place of installation (compartments)
1	BOT-80	8000	112.0	18000	1	V
2	BOT-30	3000	41.0	17500	3	II,IV,VII
3	BOT-20	1500	25.4	9000	1	III
4	BOT-12.5	1250	14.5	8500	2	IV
5	BOT-8	800	10.2	4000	3	II,IV
6	BOT-3	300	3.8	1500	2	I,VI
7	BOT-2C	200	3.9	7900	1	V
8	BOT-2O	1500	25.4	3500	1	VII

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N o t e: 1. For the present instance the actual air output through the air cooler is dependent on the electric blower capacity.

2. Heat load of BOT-30 type and BOT-20 type air coolers installed in compartment VII is given for:
- temperature of air at inlet ..... 39°C;
- temperature of cooling water ..... 28°C;
- maximum consumption of water.

Heat load of BOT-3e is set forth for:
- temperature of air at inlet..... 125°C;
- temperature of cooling water ..... 28°C;
- maximum consumption of water.

Heat load of air coolers of other types is given for:
- temperature of air at inlet ..... 35°C;
- temperature of cooling water at inlet ..... 8°C;
- maximum consumption of water.

Technical Data of Air Coolers with MB00 Type Axial-Flow Blowers Driven by D.C. Motors

T a b l e 4

Index of air cooler with axial-flow blowers	Air input capacity, m^3/hr	Cooling effect, Cal/hr	Power consumed by motor, kW	Number of air coolers	Place of installation (compartments)
15MB00	1600	6150	0.18	3	III and V
10MB00	1000	3850	0.18	1	V

N o t e: The technical data of air coolers are set forth for:
- voltage ..... 220 V;
- temperature of air at inlet ..... 8°C;
- maximum water consumption.

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- temperature of air at inlet ..... 39°C;
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- maximum consumption of water.

Heat load of BOT-3e is set forth for:
- temperature of air at inlet..... 125°C;
- temperature of cooling water ..... 28°C;
- maximum consumption of water.

Heat load of air coolers of other types is given for:
- temperature of air at inlet ..... 35°C;
- temperature of cooling water at inlet ..... 8°C;
- maximum consumption of water.

Technical Data of Air Coolers with MB00 Type Axial-Flow Blowers Driven by D.C. Motors

T a b l e 4

Index of air cooler with axial-flow blowers	Air input capacity, m^3/hr	Cooling effect, Cal/hr	Power consumed by motor, kW	Number of air coolers	Place of installation (compartments)
15MB00	1600	6150	0.18	3	III and V
10MB00	1000	3850	0.18	1	V

N o t e: The technical data of air coolers are set forth for:
- voltage ..... 220 V;
- temperature of air at inlet ..... 8°C;
- maximum water consumption.

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Type Filters

Table 5

Nos	Filter index	Rated data			
		air input capacity, m^3/hr	Air resistance of filter, mm H_2O	Number of filters	[illegible] number of units)
1	2	3	4		
1	[illegible]	200	64		
2	[illegible]	100	64		
3	[illegible]	200	25		
4	[illegible]	50	25		
5	[illegible]	200	45		

More detailed information, i.e. [illegible] description of the above equipment is set forth [illegible] technical instructions delivered to the ship together with the equipment.

3. GENERAL DESCRIPTION OF THE SYSTEM AND DESCRIPTION OF INDIVIDUAL UNITS

1. GENERAL DESCRIPTION

The ventilation and air-conditioning system consists of the following units:

(a) the ship ventilation unit;

(b) units provided to cool and dry air in compartments and spaces;

(c) units used to purify air;

(d) units employed to clean the air in the galley;

(e) the radio transmitter venting unit.

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The units of the system include: electric blowers, main pipe line air coolers, air coolers with axial-flow blowers, pipe line with necessary piping and terminal fittings.

The main pipe line air coolers and the air coolers with axial-flow blowers are cut in to the cooling water pipe line passing from the refrigeration plant GY-90 in compartment IV; with the exception of:

- air cooler BOF-8O located in compartment IV;
- air cooler BOF-2c } in compartment V;
- two air coolers 15MB00 }
- BOF-20 cooler in compartment VII

which are cut in to the sea water pipe line.

N o t e: See Maintenance Instructions for the Sea Water Pipe Line of the Air-Conditioning System.

All electric blowers and air coolers with axial-flow blowers are mounted on the AKCC type absorbers.

Rubber branch pipes are provided to connect pipe lines with bulkhead sluice valves, hull valves mounted on the conning tower as well as with electric blowers.

To minimize the air noise due to the electric blowers of the cooling units and transferred along the pipe lines silencers are mounted close to these blowers.

The watertight recesses (battery wells and provision tanks) are equipped with gas-proof flaps and valves. The gas-proof flap and two throttle valves are also mounted on cross-connection between supply blowers and exhausters.

The attachment of pipe lines to the hull structures is accomplished by means of hangers with rubber gaskets.

In each compartment lower sections of pipe lines, in places where water may accumulate, are provided with drain plugs.

2. DESCRIPTION OF INDIVIDUAL UNITS

(a) Ship Ventilating Unit

The ship ventilating unit is used to ventilate compartments and spaces of the submarine as well as the battery wells with outer air when on surface and when snorkeling.

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The unit includes:

- two 10000 PM380 type electric blowers located in compartment V;
- the BOT-80 type mains air-cooler mounted on the supply mains in compartment IV. It serves to cool air fed to the forward group of compartments (I - IV);
- two mains running throughout the length of the submarine: the supply mains passing along the starboard side and the exhaust one, along the port side.

Sluice valves with bilateral valve gear drives are installed in places where the mains pass through bulkheads, and a hull valve is set in the place where the conning tower ventilating pipe enters the pressure hull.

Offsets branch out to the submarine spaces from the vent mains in each compartment. The former are equipped with control and shut-off fittings.

The suction pipe of the ship supply electric blower is connected to the starboard side diesel engines air delivery trunk by means of a pipe through throttle valve 129.

The supply electric blower intakes air from the trunk and delivers it along the supply main to all compartments and spaces through supply offsets provided with air regulators and ventilators.

To ventilate the battery wells in compartments II and IV, when charging batteries, outer air is fed to these compartments through supply main offsets equipped with throttle valves 20, 91. The air from the compartment flows to battery wells through ventilation valves 32,103 as a result of air rarefaction in these wells created by the operation of the ship exhauster.

Valves 32 and 103 are cut in to supply headers in the battery wells.

When diesel engines operate, the input of fresh air from the trunk to the supply electric blower is controlled by a throttle valve mounted on the trunk outlet.

In fresh weather when the submarine is snorkeling the sea water from the air delivery trunk used to feed air to

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the starboard diesel engines is likely to get into the supply main. To avoid this, the supply electric blower suction line is provided with a pipe branch located close to the air delivery trunk outlet.

The pipe branch has a bell-mouth and throttle valve 133.

In this case fresh air flows to the supply electric blower from compartment V. To this compartment air is fed from the air delivery trunk of the starboard diesel engines with throttle valve 129 in the CLOSED position and flap 128 completely open.

The exhauster intakes air from compartments, spaces, food storage spaces and battery wells and discharges it into the air delivery trunk intended to feed air to the port side diesel engines (But when ventilating battery wells, the exhauster intakes the air from compartments II and IV only through these wells). Then, according to the number of diesel engines in operation, air is discharged to the weather through the port side diesel engine air delivery trunk, open hull valve 148 and the pipe line in the superstructure or it is led to compartment V to operating diesel engines through the open throttle valve 147.

To drain water from the electric blowers volutes the latter are provided with drainage pipes running to the bilge.

(b) Individual Electric Torpedo Ventilation Units Located in Compartments I and VII

These units are provided to ventilate electric torpedo battery compartments.

The two of these units are located in compartment I, and one unit in compartment VII.

The units include:

In compartment I:

the first unit:

- the ЗИСЛ-11 type electric blower;
- the ФМС-100РУ type filter;
- the ВОТ-3 type air cooler;

the second unit:

- the ЗИСЛ-11 type electric blower;
- ФМС-100ВУ type filter;

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in compartment VII: - the 3UOP-11 electric blower;
- the ФМС-100ВУ filter;
- the ФМП-200/400У filter that serves to purify air in this compartment.

In addition, T-pipes with flaps, vacuum gauges, detachable hoses and tubes are organic parts of each unit.

Running of units: detachable hoses are connected to special ventilation holes on the electric torpedo body in the area of the battery compartment. An operating electric blower sucks out the air from the battery compartment through the ФМС filter and discharges it into the submarine compartment. The filter purifies air from antimonous hydrogen and sulfuric acid aerosols.

WARNING! When the units are in operation the air in the battery compartments is rarefied. Rarefaction value (40 mm H_2O is controlled by vacuum gauges and regulated with the help of throttle valves in T-pipes, if necessary.

The electric torpedo ventilating units installed in compartment I are employed to purify air in it. For this purpose it is necessary to remove detachable hoses from T-pipes. The air from compartment passes through the ФМС filter, gets purified and then is discharged to the compartment. The air flow through filters in compartment I should not exceed 100 m^3/hr.

In compartment VII air is purified by the ФМП-200/400У type filter connected to the electric torpedo ventilating unit. The air flow through this filter should be about 300 m^3/hr. To start the unit, it is necessary to open flap and close T-pipe flaps.

The 3OP-3 type air cooler forming a part of the first unit of compartment I is provided to cool the air of this compartment.

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(c) Individual Units Provided to Ventilate Battery Wells in Compartments II and IV

These units serve to ventilate battery wells when the submarine runs submerged. Two ventilation units located in each compartment are meant for ventilation of forward and after groups of battery wells.

Each unit consists of:

- the 3KCH-17 type electric blower;
- the 6KC type filter;
- the pipe line equipped with cutting-off and regulating fittings.

Running of units: The electric blower intakes air from the battery wells through the 6KC type filter that absorbs antimonous hydrogen and sulfuric acid aerosols. Then, the purified air is discharged into the compartment where from it flows into the battery wells through open ventilation valves 32, 103, as a result of air rarefaction created in the wells by the operating ventilation units.

When the submarine runs submerged the individual units provided to ventilate the battery wells are started up in accordance with the storage battery maintenance instructions.

The battery well ventilation units are used to purify air in compartments when submerged. It is done as follows: air from compartment II is sucked in by electric blowers through ventilators 42 and 46, then it passes through filters and is discharged into the compartment.

Air in compartment IV is sucked in by electric blowers through ventilators 114 and 119 mounted on the pipe line, passes through the filter and then is discharged to the compartment.

(d) Galley Individual Ventilation Unit in Compartment IV

The unit is designed to cool and purify air of the galley spaces when submerged and while charging storage batteries with the galley range in operation.

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The unit includes:

- the [redacted]-17 type electric blower;
- the [redacted]-8 type air cooler;
- the [redacted]-200/400V type filter;
- the pipe line with fittings and silencers.

Unit running: the electric blower intakes the air from under the galley range umbrella through the air cooler and feeds it to the galley again; some amount of air passes through the filter and is discharged into the compartment through open throttle valve 117 for the purpose of creating rarefaction in the galley recess in relation to air density in the compartment and thus preventing fumes from spreading all over the compartment.

To ventilate the galley by means of the ship electric blower when the submarine is on surface, the unit is cut in to the ventilation exhaust line with the help of cross-connection with throttle valve 97, throttle valve 99 being closed.

The unit is started up while using the galley when the submarine runs submerged and while charging the storage batteries. In this case throttle valve 99 must be opened but throttle valve 97 mounted on cross-connection should be clos

(e) Individual Units Provided to Purify Air in W.C. of Compartment III and W.C. and Shower of Compartment VI

The purpose of these units is to purify air in W.C. recesses and in the shower from physiological impurities.

The units consist of:

in compartment III:

- the [redacted]-11 type electric blower;
- the [redacted]-50/100V type filter and a pipe line with fittings;

in compartment VI:

- the [redacted]-11 type electric blower;
- the [redacted]-50/100 V type filter;

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- the BOF-5 type air cooler and a pipe line with fittings.

Unit running: in compartment III - the electric blower inducts air from the W.C. recess and discharges it through the filter to the compartment. The air passes to the W.C. recess from the compartment through ventilator 79. Ventilator 80 is provided to control air input of the filter (50 m^3/hr).

The W.C. ventilation unit installed in compartment VI operates in exactly the same way as in compartment III but flaps 163 and 169 are in the closed position and flaps 164, 165, 166 and 175, in the open position.

When the shower ventilation unit operates, the air from the shower is intaken through the BOF-5 type air cooler and discharged partially to the W.C. through ventilator 175 and partially through the filter. Air passes to the shower through untight bulkheads of the shower recess as a result of air rarefaction created by the electric blower. The ventilator 166 and flap 169 should be shut but ventilators 165 and 175 and flaps 163 and 164 should be open.

The unit in compartment VI is cut in to the ventilation exhaust line by means of a cross-connection with flap 169 used to ventilate the W.C. and shower recess by the ship electric blower when on surface.

When the shower is ventilated by means of the individual ventilation unit, it is forbidden to make use of the W.C. to avoid spreading of fumes all over the compartment.

The units are started:

1. When making use of W.C.
2. After washing in the shower.
3. While drying clothes in the shower.

(c) Individual Unit Provided to Absorb Carbon Monoxide in Compartment V

This unit is provided to absorb carbon monoxide in compartment V after crash dive when the exhaust fumes are likely to inflow compartment V as a result of urgent stoppage

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of diesel-engines and shutting off the diesel-engine exhaust flap.

The unit includes:

- the ЭЦСН-24 type electric blower;
- the ВОТ-2С special type air cooler;
- the ФИЭ-200Г type filter;
- the ФИЭ-200/400 У type filter;
- the pipe line with shut-off fittings.

Unit running: air is inducted from compartment V, purified in consecutive order by means of the ЦИТ and ФИЭ filters, cooled by the air-cooler and discharged to the engine-control recess. The air in compartment is rarefied relative to the engine-control recess and due to this gases do not flow out of the compartment. The unit operation is checked by means of a distant-reading thermometer mounted behind the filter. The constant thermal conditions temperature should be 105 - 125° according to the control thermometer.

N o t e: 1. The distant-reading thermometer readings should be checked by the control thermometer at the constant thermal conditions.
2. To protect the ФИЭ-200Г type filter catalyst, valves 151 and 152 must always be in the shut-off position if the unit is off.
3. When starting up the unit, first cut in the electric blower, then the ФИЭ-200Г filter.

Start up the unit after crash dive.

N o t e: 1. When in base or while welding, painting or carrying out other repairs, it is necessary to extract all filter cells and take them out of the compartment.
All repair works have been finished, the compartments and spaces should be ventilated and only then put the filter cells on their places before starting filters.

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2. Air flow through the filters of the units provided to clear air in W.C. should not exceed the filter rated capacity - 50 m^3/hr.

Purpose, number of filter cells in a filter, compartments of the submarine where filters are installed and filter cell indexes are listed in Table 6.

Table 6

Compartment	Filter mark	Filter cell		Purpose
		mark	number of cells in filter	
I	ФМС-100БУ	ФК-БУ	1	To ventilate electric torpedoes (to absorb antimonous and sulfuric acid aerosols).
	ФМС-100БУ	ФК-БУ	1	
II	ФМС-100БУ	ФК-БУ	1	To ventilate battery wells
	ФМС-200БУ	ФК-БУ	2	
III	ФМЕ-50/100У	ФК-У	1	To absorb physiological impurities from air of the W.C.
IV	ФМС-200БУ	ФК-БУ	2	To ventilate battery wells
	ФМС-200БУ	ФК-БУ	2	
	ФМЕ-200/400У	ФК-У	4	To purify air of the galley
V	ФМГ-200Г	ФК-Г	2	To absorb CO in compartment V
	ФМЕ-200/400У	ФК-У	2	
VI	ФМЕ-50/100У	ФК-У	1	To purify air of the W.C. and shower

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N o t e: 1. Air distributing valve 98, feeding air to the galley recess is in the open position only when the galley air cooling and purifying individual unit is inactive.

2. Radio transmitter cooling unit installed in the radio room includes:
- the 8НСВ-17 type electric blower;
- the ВОР-8 type air cooler;
- silencers and pipe line with fittings.

Unit running: the electric blower inducts air from the radio transmitter. The cooled air is then supplied to the radio room and petty officers' wardroom. Throttle valve 110, air-distributing valves 108 and 109, and ventilators 106 are set in the open position. When the radio transmitter is inactive the ventilation unit is used to cool air in the radio room and in the petty officers' wardroom.

In this case throttle valve 110 is shut off and air is inducted from the air-conditioning room; the cooled air is then fed to the wardroom and radio room proper. Ventilators 106, 111 and air-distributing valves 108 and 109 are in the open position.

In compartment V:

1. Unit intended to cool air in compartment V consists of two air coolers with axial-flow electric blowers of the 10МВ00 type.

2. Diesel-engine control recess air-cooling unit includes an air cooler with the 10МВ00 type axial-flow electric blower.

In compartment VI:
- the 8НСВ-11 type electric blower;
- the ВОР-6 type air cooler;
- the pipe line with fittings and silencers.

Unit running: the electric blower inducts air from the compartment and feeds it into the air cooler. The cooled air is then distributed among battle stations in the compart-

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In compartment VII:
the 1st unit includes:
- the [illegible]-11 type electric blower;
- the [illegible]-20 type air cooler;
- the pipe line with fittings and silencers.

The electric blower of this unit is enclosed in a soundproof housing that prevents noise from spreading all over the compartment.

Unit running: the electric blower [illegible] air from the soundproof housing and delivers it to [illegible] the compartment through the air cooler.

Air enters the soundproof housing through the silencer as a result of air rarefaction created by the electric blower while operating.

The 2nd unit consists of:
- the [illegible]-11 type electric blower;
- the [illegible]-20 type air cooler;
- the pipe line with fittings and silencers.

Unit running: the electric blower induces air from the [illegible] and discharges it through the air cooler to the [illegible] spaces. Air passes to the lower spaces through [illegible] as a result of air rarefaction created by the electric blower.

[illegible] OF INDIVIDUAL UNITS. WATER-[illegible] VENTILATION STRAIGHT-WAY VALVE

[illegible] Fig. 1)

The water-gas-proof ventilation straight-way valve is used to shut off ventilation pipe lines that should be watertight. The straight-way valve housing 201 is [illegible] and provided with a coaming and two flanges used to [illegible] the valve to the pipe line. The straight-way valve opening is closed by plate 203 that is secured on lever 204. To [illegible] better packing when in the shut-off position, the plate is provided with a packing rubber ring secured to the plate by means of a pressure disk 205.

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Bushes are welded inside the straight-way valve housing they serve as bearings for shaft 202. Lever 204 with plate 203 is keyed on shaft 202. A worm gear that engages worm roller 206 is shrink-fitted on shaft 202.

Housing 207 is provided to cover the worm gear. Index plate 210 is attached to housing 207. The extreme positions of plate 203 "O" - OPEN and "C" - CLOSED are engraved on the index piece. Indicator 209 is fixed to shaft [illegible].

In order to inspect the straight -way valve, the housing is provided with detachable lid 208.

Sluice Valve

(See Dwg 10)

The sluice valve is provided to shut off the ventilation pipe lines at places where they pass through pressure bulkheads. The valve is equipped with bilateral [illegible] gear that permits opening and closing it on either side of the bulkhead.

The sluice valve consists of body 217 secured on one side to a sleeve welded to the bulkhead and on the other through the shock absorber branch pipe to the ship ventilation pipe line. The sluice valve disc 218 used to shut the vent hole is housed in the body 217. Disc 218 travels in the body by means of a guide screw and a lead nut fixed in the disc. Bevel gear 211 transmits motion from flywheel 214 to the guide screw. The driving gear passes from the sluice valve to the adjacent compartment through the bulkhead pressed with weld-on 212 and stuffing box 216.

The driving gear is equipped with an indicator to show the OPEN or CLOSED position of the sluice valve. The indicator includes an indicating column 213 and indicator proper 215. The extreme positions of the sluice valve disc 218: "O" - OPEN and "C" - CLOSED are engraved on the indicating column.

Cup-Type Vacuum Gauge

(See Dwg 11)

This designed to determine the air rarefaction in the battery wells and in electric torpedoes while ventilating.

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The vacuum gauge is made of plexiglass and consists of body 219 and zero adjuster 220.

The body container is filled with water tinted with ink used in fountain pens.

The vacuum gauge body has graduations on both sides along the vertical column which makes it possible to take readings in millimeters of the water column. Division value is one millimeter of the water column.

The zero level of water in the vacuum gauge container and in the graduated column is regulated with the help of zero adjuster 220 screwed into the container.

.. OPERATING CONDITIONS

The ventilation and air-conditioning system operating conditions are as follows:

Operating condition I:

ventilation of submarine accommodations and spaces when on the surface or when snorkeling.

Operating condition II:

ventilation of submarine battery wells, accommodations and spaces when on the surface or when snorkeling.

Operating condition III:

ventilation and revitalination of air in submarine accommodations and spaces when running submerged.

Operating condition I

Ventilation of Submarine Accommodations when on the Surface or Snorkeling

Two electric blowers located in compartment V are used for ventilating accommodations and spaces by outer air. The three-induction electric blower draws fresh air through the starboard diesel engine air delivery trunk and

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feeds it along the supply ventilation main through branch pipes with fittings in compartments and spaces of the submarine. The air fed to compartments I-IV is cooled in the POR-40 type air cooler installed in compartment IV.

The ship exhaust electric blower induces contaminated air from compartments and spaces of the submarine through respective fittings mounted on the exhaust ventilation main installed in each compartment and discharges it outboard to the atmosphere or to compartment V depending on the running conditions and number of operating diesel engines.

Positions of the system valves according to the operating condition are listed in the tables below.

[illegible] When diesel engines are inactive:

[illegible] contaminated air is exhausted to the atmosphere through the port side diesel engine air delivery trunk and the ship line in the superstructure.

[illegible] valves 138 and 148 in compartment V are in the open position, but flaps 139 and 147 mounted on the diesel engine air delivery trunks are closed.

[illegible] When cruising on the surface under one diesel engine:

[illegible] required amount of air necessary for the diesel engine operation is fed to compartment V from the exhauster along the port side diesel engine air delivery trunk; the air is discharged to the atmosphere through hull valve 148, the ship line in the superstructure and the air trunk in the conning tower.

[illegible] valves 138 and 148, flap 147 are in the open position, flap 139, in the closed position.

[illegible] When cruising on the surface under two or three diesel engines:

All air from the exhauster is discharged into compartment V through the port side diesel engine air delivery trunk located in the compartment. Additional amount of air necessary for the diesel engines operation is supplied to compartment V along the trunks from the atmosphere as a

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result of air rarefaction created by the running diesel engines in this compartment.

Flaps 128, 147 and hull valves 126, 148 are open.

(d) When snorkeling

In contradistinction to the surface cruising hull valve 148 on the port side is closed.

When snorkeling under one running diesel engine the supply electric blower intakes air through the starboard diesel engine air delivery trunk and feeds it to spaces; flap 128 in the trunk is closed. The exhauster intakes air from compartments and discharges it to the diesel engine in compartment V through the port side diesel engine snorkel mast flap 147 is in the open position.

To avoid pressure increase in compartment V, the throttle valves should be set as follows: valve 132 on..... position, valve 146 in.....position from closed position as the capacity of the ship electric blowers exceeds the diesel engine requirements for air.

When snorkeling under two running diesel engines the supply electric blower cannot provide diesel engines with the necessary amount of air, and so the air rarefaction is created in compartment V. The rest amount of air passes through the starboard diesel engine snorkel mast as a result of the vacuum. Flap 128 and throttle valve 146 are closed.

Operating Condition II

Ventilation of Submarine Battery Wells Accommodations and Spaces when Cruising on the Surface or When Snorkeling

The system runs under these operating conditions while simultaneously ventilating battery wells, and also when storage batteries are charged and accommodations and spaces being ventilated at the same time.

Outer air is intaken by the supply electric blower from the starboard diesel engine air delivery trunk and forced

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[redacted]

[redacted] to compartments I-II, VI and VII [redacted]
[redacted] diesel engine control posts located in compart-
[redacted] ments I, II, compartments II and IV the air from the port ring
[redacted] is delivered to the battery wells through valves 38 and 108.

Air from compartment I flows into compartment II through
the branch pipe with shut valves 39, the throttle valve 39
[redacted] Further amount of air from compartment III flows
[redacted] compartment II through valve 55.

[redacted] foul air is sucked in by the exhauster from the
[redacted] valve, compartments III, VI, VII, and from the recess
[redacted] compartment I and then discharged to compartment V.

[redacted] of the system valves are given in the operat-
[redacted] tables below. The position of the hull
[redacted] throttle valves 126, 147 are given in
[redacted] with operating condition I depending on the num-
[redacted] engines in operation when cruising on the sur-

[redacted]

[redacted] running diesel engine in order to ventilate
[redacted] and to avoid the increasing of air pressure
[redacted], it is necessary to set flaps as follows:
[redacted], two in ... position from closed posi-
[redacted] compartments are cut off by means of flaps 134
[redacted] closed.

[redacted] two running diesel engines the position of hull
[redacted] and throttle valves 126, 146, 147
[redacted] operating condition I when the submarine is
[redacted] two running diesel engines.

[redacted] Condition III

[redacted] and Revitalization of Air
[redacted] Compartments, Accommodations and Spaces
[redacted] Submarine Submerged

Under these conditions all units provided to cool and
[redacted] air in the submarine compartments and spaces are put in
[redacted].

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[redacted]

[redacted] ventilation and air purification units are
[redacted] to item 3, a, 4, b, f, Para.2, description
[redacted] fittings.

[redacted] the system fittings are listed in operating
[redacted] below.

[redacted]

[redacted] the above mentioned operating conditions
[redacted] system may be used:

[redacted] sub-

[redacted] and exhaust electric blowers are
[redacted] to work the submarine

[redacted] compartments
[redacted] pipe line
[redacted] terminal fittings

[redacted] flaps 131
[redacted] are shut off.
[redacted] operation,
[redacted] are in
[redacted] shut off position.

[redacted] number of cases in con-
[redacted]

[redacted] in compartments
[redacted] the fire, during weld-

[redacted] welding it is neces-
[redacted] compartments by the
[redacted] compartments should be
[redacted] valves (except
[redacted] which are not
[redacted] in the closed position.

[redacted] operating conditions see that
[redacted] 14, 14' and 14b are in the closed position.

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[redacted]

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The time necessary for one change of air in each compartment (the ship electric blowers work only for this compartment) is given in Table 10.

3. To test the pressure hull for tightness

To test the pressure hull for tightness it is necessary to create the vacuum in submarine compartments with the aid of an exhauster. Do it as follows:

- open shut and terminal fittings mounted on the exhaust line;
- open hull valve 148 and see that throttle valve 147 is closed;
- set up the other valves in the original position;
- cut in the ship exhauster and create the vacuum;
- shut off hull valve 148 and cut off the exhauster.

After the test equalize the pressure by opening hull valve 148.

N o t e: All manipulations with valves 125, 147 mounted on the diesel engine air delivery trunk and with hull valves 126, 148 are carried out in accordance with the Maintenance Instructions for the air supply system and snorkeling arrangement.

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[redacted]

II. [redacted] INSTRUCTIONS
[redacted] SYSTEM [redacted]
[redacted]

A. [redacted]

1. To maintain the ventilation and air-conditioning system ready for operation, it is necessary to accomplish its inspection and repairs in time according to Para. 1 of [redacted] Instruction.

2. When [redacted] painting any compartment of the submarine or when the submarine is in the base, all the filters in the compartment should be sealed hermetically and [redacted] taken away.

B. [redacted]

1. [redacted]

1. The ventilation and air-conditioning system original [redacted] base:

- [redacted] and pipe fittings, the pressure house [redacted] and bulkhead sluice valves are closed, [redacted] of throttle valves 38, 127, 134, 143 and [redacted], 46, 114 and 119, special valves 32, [redacted] 43, 44, 47, 48, 113, 115, 118 and 120 [redacted] the open position;
- [redacted] electric blowers are out off
- [redacted] are equipped with filter cells.

[redacted] system for operation.

[redacted] principal operating conditions, it is [redacted]:

- [redacted] readiness of electric blowers for operation;
- to make connection of air-coolers to mains feeding the cooling water;
- to accomplish the necessary operating conditions the system fittings should be set in the position according to Tables in [redacted] 5-8;
- before starting the exhauster when ventilating the battery wells, it is required to take measures to reduce hydrogen concentration in the pipes close to the blowers.

[redacted]

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[redacted]

It is necessary to open valve 210, close all bilge valves on the exhaust pipe lines and close flaps 12, 14, 15, 16, 113, 115, 116 and 120 and wait five minutes.

The water level in the vacuum gauges should be equal to the zero reading.

[redacted]

1. Starting

[redacted]

2. Maintenance During Operation

[redacted]

Ventilate battery wells in accordance with the sub-section on page Battery Maintenance Instructions.

When ventilating the battery wells, keep an eye on the vacuum gauge readings: they should not be less then values listed in the Table below.

T a b l e 7

Battery wells	Compartment II				Compartment IV			
	forward		after		forward		after	
	vacuum gauges							
	upper	lower	upper	lower	upper	lower	upper	lo
Vacuum gauge readings								

[redacted]

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13. Plugs 43, 44, 47, 48, 113, 115, 118 and 120 must be screwed up to the limiter in all ventilating conditions and must be [illegible] only in case of emergency when it is necessary to flood the battery wells.

14. If the submarine dives immediately after charging or while charging the storage batteries as well as when putting the ventilation and air-conditioning system to operation [illegible] 111, the battery wells must be ventilated by means of the individual air-purification units:

[illegible], immediately after the ship electric blowers have been stopped, proceed as follows:

(a) close bulkhead sluice valves;

(b) close throttle valves 29, 36, 87, 96 connecting exhaust branch pipes of the battery wells to the exhaust line;

(c) [illegible] individual electric blowers;

(d) open throttle valves 41, 45, 112, 121 connecting exhaust branch pipes of the battery wells to the suction side of the electric blowers;

(e) ventilate the battery wells by means of the individual units until it becomes possible to ventilate them to the atmosphere from the engine room by means of the ship blowers when diesel engines are running.

[illegible] torpedoes are ventilated in accordance with the [illegible] torpedo maintenance and storage Instructions.

16. Watch the vacuum gauge readings while ventilating electric compartments. They should be equal to 40 mm H_2O.

17. After the crash dive cut in the air-purification unit in compartment V for 4 hours to purify air from carbon monoxide and nitric oxides.

18. Filter cells of air-purification units are replaced before the independent cruising.

3. Damage-Control Measures

19. When one of the ship electric blowers is damaged:

(a) if diesel engines are not in operation - air is exhausted by the second ship electric blower. Air supply is

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through the diesel engine air-delivery trunk, cooling tower hatch and supply line as a result of the air circulation created in the submarine by the electric blower operation;

achieved through the diesel engine air-delivery trunk, cooling tower hatch and supply line as a result of the air circulation created in the submarine by the electric blower operation;

(b) if diesel engines are in operation - air through electric blower intake for feed the diesel engine air delivery trunk and through it into the engine room, the cooling tank and engine room, from where the heated air is exhausted through the exhaust line and overboard;

(c) during charging the storage batteries - air is delivered by the electric blower. The air supply is accomplished through the air-delivery trunk, cooling tank and supply line as a result of the air circulation in the submarine.

(d) in case of casualty if the refrigerating plant and ventilation are switched off and temperature in the compartments exceeds 35° C, the temperature is to be reduced.

Under normal conditions I and II

To cut out the following equipment in compartment III:

1. Converter [illegible];
2. One gyrocompass [illegible] (MKPC-5);
3. Converter AMT-[illegible];
4. Bilge pump PN-1.

In compartment IV:

1. To cut off the NNB 40/15 type pump that is used to pump water through the refrigerating plant compressor.

2. To cut in only one mess kettle in the galley when cooking.

In compartment VI:

To switch the AMO-8-50 type converters to full range (if converter AMO-8-50 in compartment III is off).

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[redacted]

[redacted]

[redacted]

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[redacted]

Table 3

Troubles	Possible cause of trouble	Remedy under ship conditions
1	2	3
Pipe line tight- [illegible] leaked	(a) mechanical damage	Replace the damaged section of pipe line
	(b) gasket is damaged	Replace gasket
	(c) flanged joint or pipe connector is loose	Tighten nuts on the pipe connection
[illegible] valve [illegible]	(d) strainers on the ground pipes of the pipe line are choked	Clean strainers
	(e) pipe valves are shut off	Check the position of fittings according to the given operating conditions
	(f) the electric blower is out of repair	Remedies are listed in the electric blower maintenance Instructions
Valves of fittings run with difficulty [illegible] great effort	(a) friction assemblies are not lubricated	Lubricate friction assemblies thoroughly
	(b) nut glands are too tight	Loosen glands or replace their packing

5. SYSTEM INSPECTION AND REPAIR

The equipment of the ventilation and air-conditioning system is inspected and repaired in accordance with the instructions furnished with the equipment.

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1. DAILY INSPECTION

29. Inspect pipe lines and fittings. See that shock absorbing flexible pipes and vacuum gauges are in good condition.

30. Make sure electric blowers of the individual air-breathing units and of battery wells are in good order.

31. Inspect and test supply and exhaust electric blowers.

2. WEEKLY INSPECTION

In addition to the daily inspection the following must be carried out:

32. Open over all bulkhead sluice valves, throttle valves and flaps.

33. Check the condition of the bulkhead sluice valves and ventilation shafts if necessary. See that ON and OFF indicators on the bulkhead sluice valves are in good condition.

3. INSPECTION EVERY SIX MONTHS

In addition to the weekly inspection it is necessary to do the following:

34. Open and examine the condition of flaps coamings and packing rubber.

35. Check the FMT-200P type filter thermal relay operation by the control thermometer readings.

4. INSPECTION WHEN PERFORMING ROUTINE REPAIR OF THE SUBMARINE

32. If technical conditions require , reset and repair bulkhead sluice valves, flaps, throttle valves, supply and exhaust ventilation lines.

33. When testing compartments tightness, check the tightness of sluice valves. Test gasproof flaps for tightness.

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34. The system fittings are set in positions according to operating condition I or II.

The running tower hatch and bulkhead doors between compartments are open. Measure the barometric pressure.

35. Put in the exhauster and measure air flow in compartments.

In case of necessity the air flow is regulated by means of the standard fittings on the branch pipes. The exhauster is to be put off.

N o t e: The air flow is measured at the pipe line outlet in each compartment by means of a micromanometer with a pneumatic pipe.

36. Put in the supply blower and carry out operations similar to those in Items 34-35.

37. Close the running tower hatch and all bulkhead doors between compartments.

Put in the supply and exhaust blowers. By changing if necessary, the amount of opening of valves and flaps mounted on the supply and exhaust branch pipes adjust the distribution of air among the compartments in accordance with the data listed in table 9; the pressure drop in compartments should not exceed 3 mm Hg.

N o t e: The air flow at sections for the given pipe line is determined by the value of the mean pressure head according to the formula:

$$Q = 1.15\ d^2\sqrt{h},\ m^3/hr$$

where: d - internal diameter of the pipe line, cm.

h - pressure head, mm H_2O

38. The pressure head is measured at 4 - 5 points along the cross section of the pipe line. The mean pressure head is determined as the arithmetical mean of these measurements.

N o t e: 1. When using the micromanometer, pay special attention to its horizontal adjustment and

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[redacted]

[redacted] first of all to its longitudinal direction.

[redacted]. The pneumatic tube is mounted inside the pipe line parallel to its axis, the pipe end being turned to face air stream.

[redacted]. The pressure head is determined as the product of the pressure gauge readings and the pipe scale factor, given in the mounting pipe chart.

[redacted]

[redacted] of air about Compartments when under [redacted] and II.

Table 9

[redacted]	[redacted] quantity of air in cu. ft. [redacted] cu.ft.	Required quantity of air when under operating condition II, cu.ft/hr	
		Supply	Exhaust
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
Recirculating Compartments			
[redacted]	750	750	-
[redacted]	1925	1300	1300
[redacted]	925	700	700
[redacted]	[redacted]	9500	9500

[redacted] necessary to accomplish one change of air in each compartment when the ship electric blowers operate only for this compartment, is shown in Table 10.

[redacted]

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Compartment	I	II	III	IV	V	VI	VII
Time necessary to accomplish one change of air, min							

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APPENDICES

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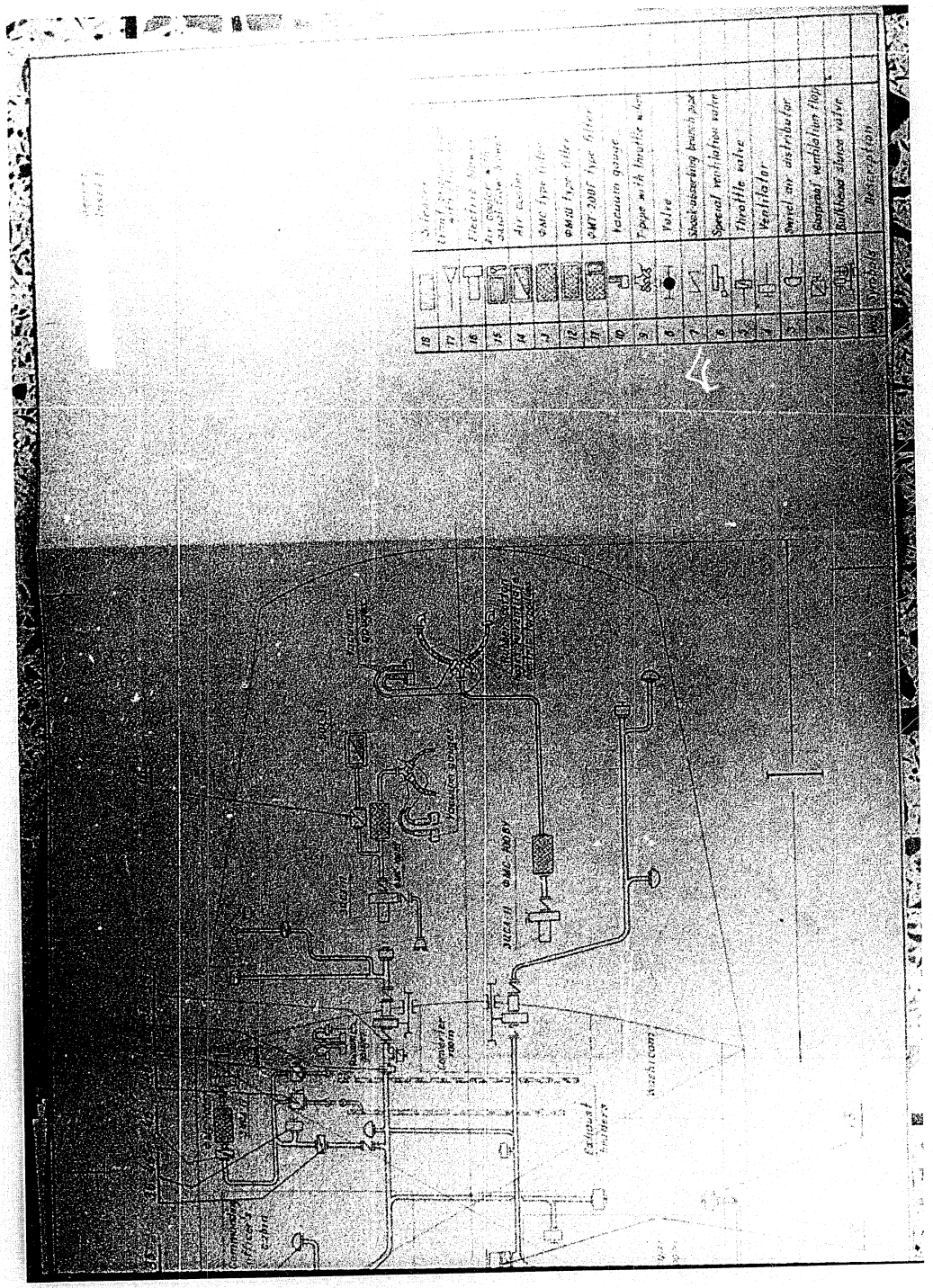

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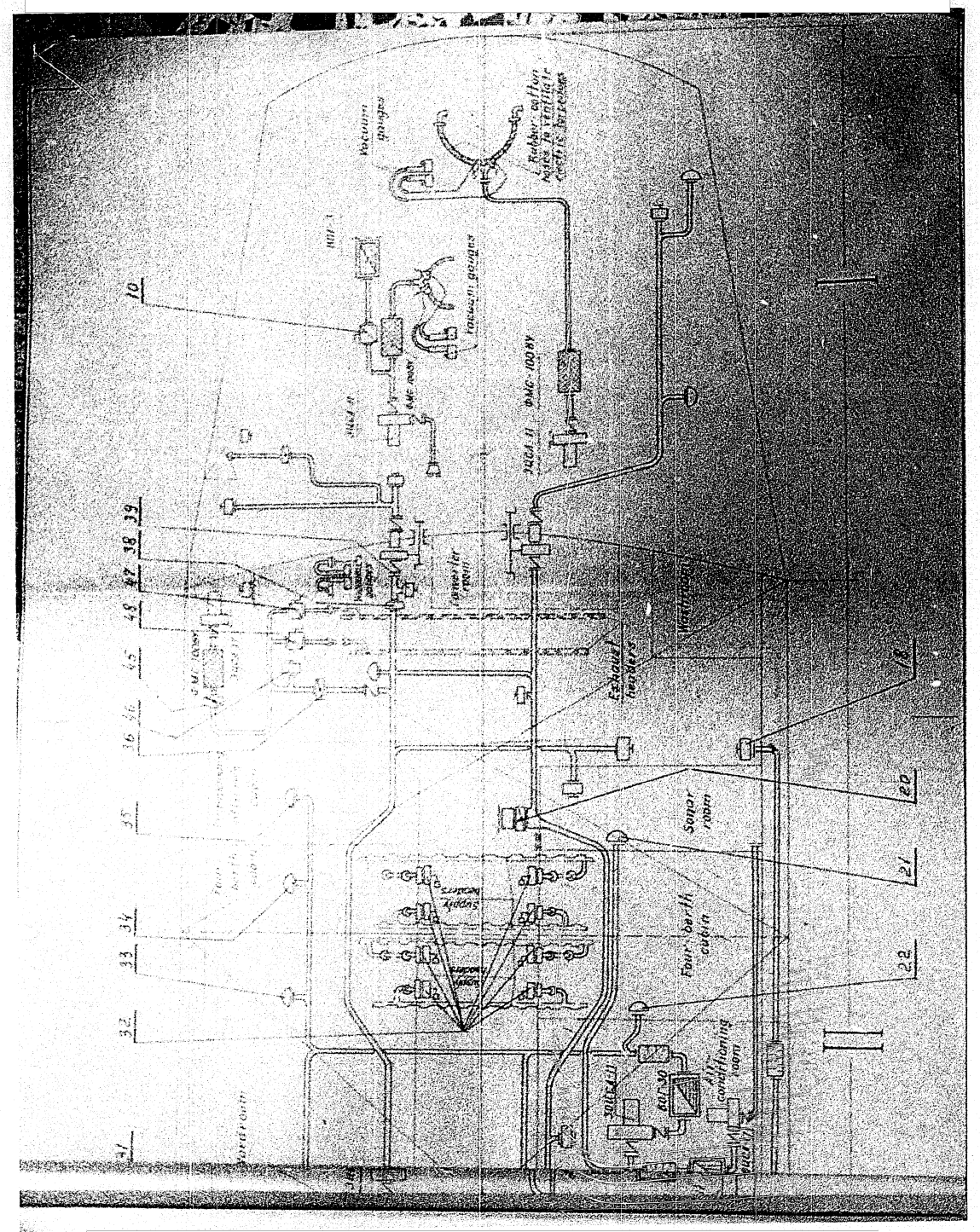

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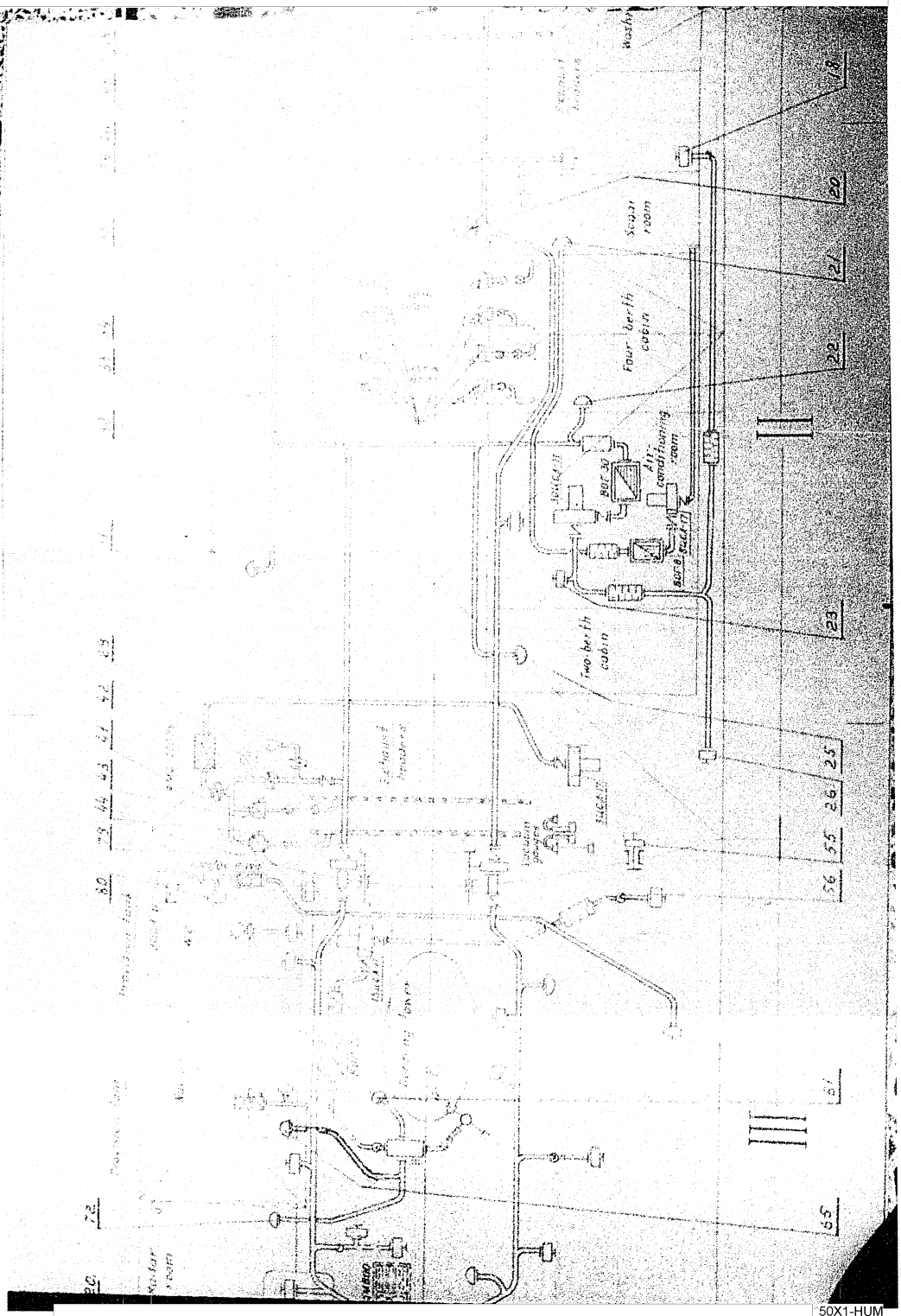

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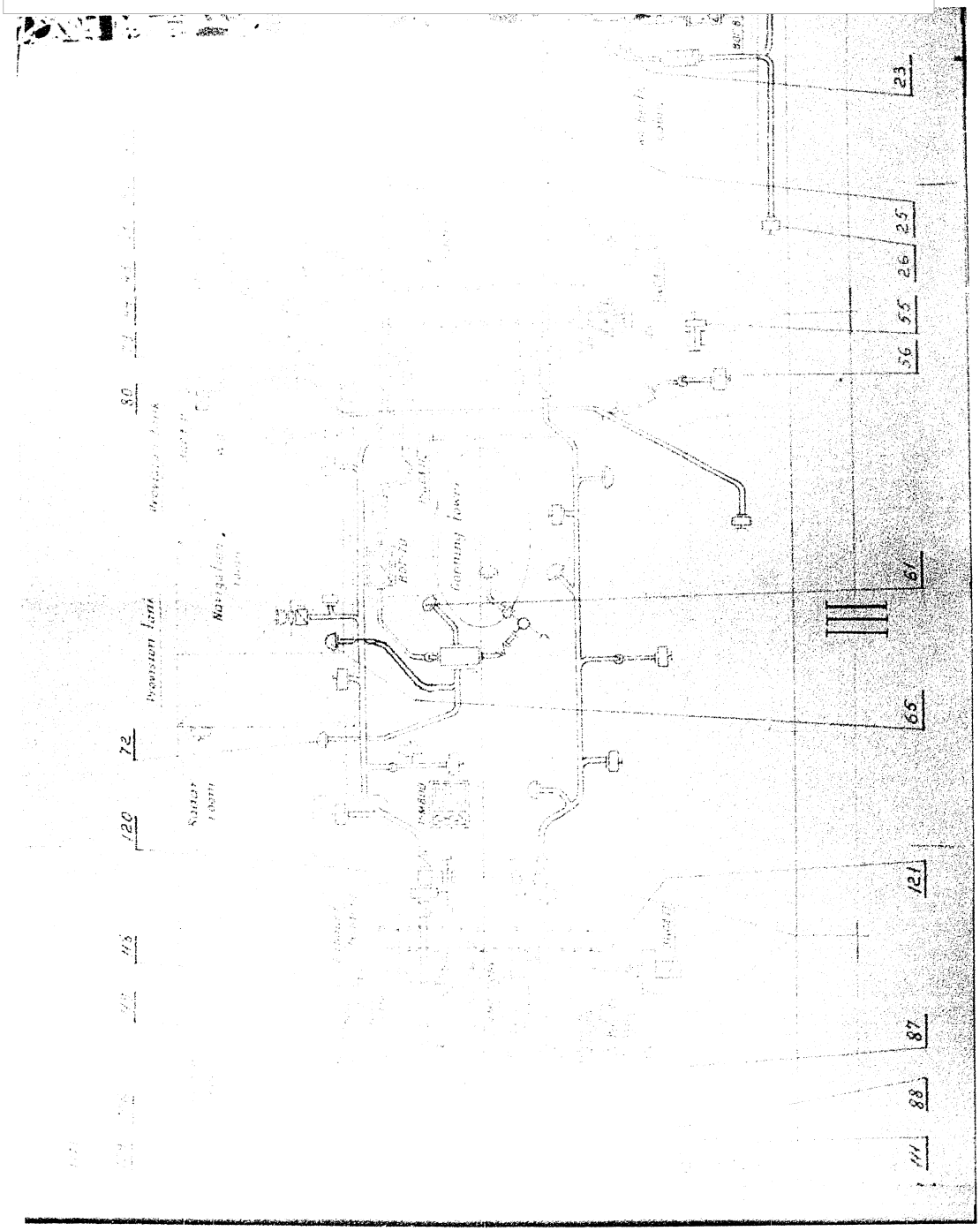

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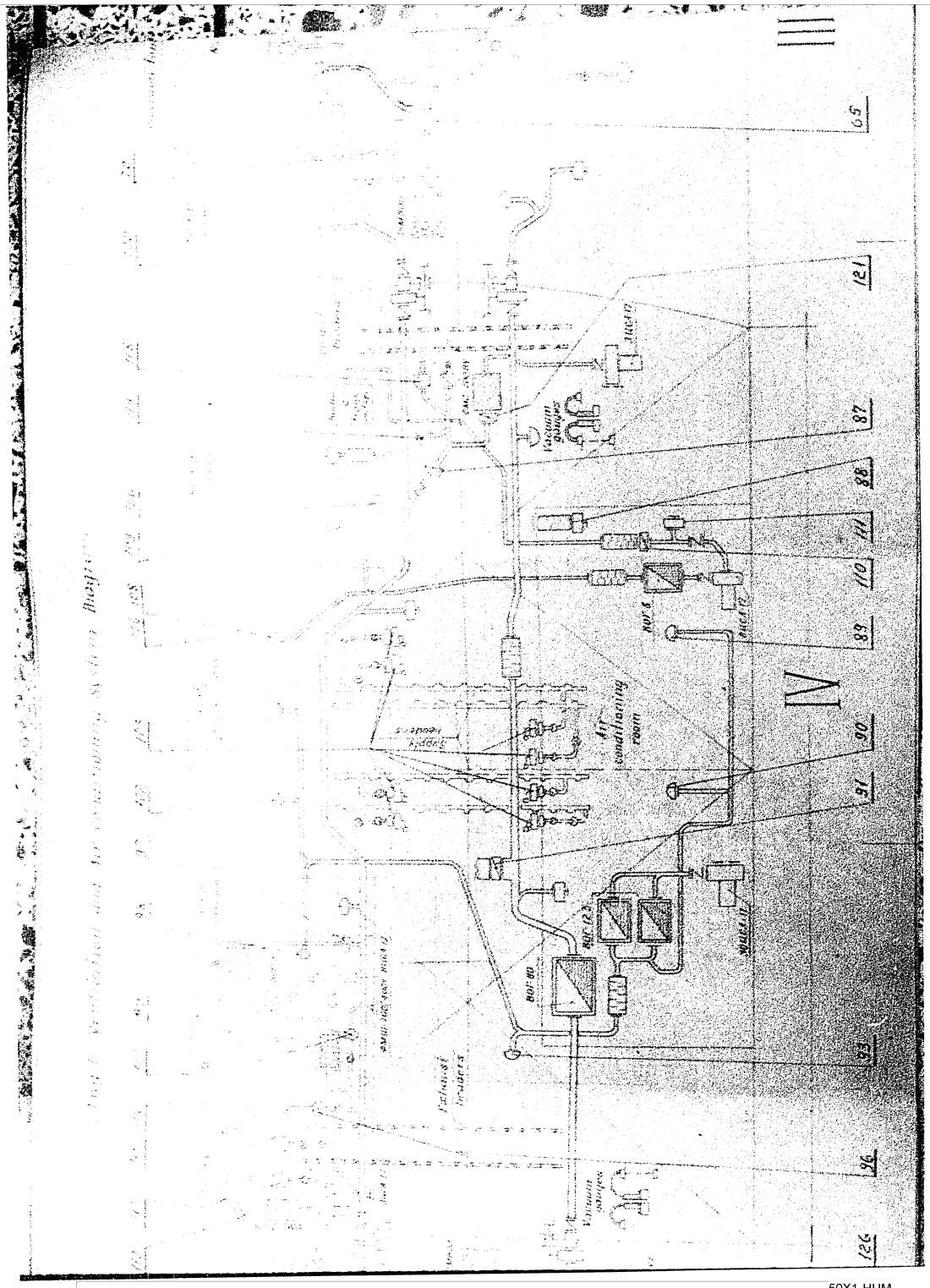

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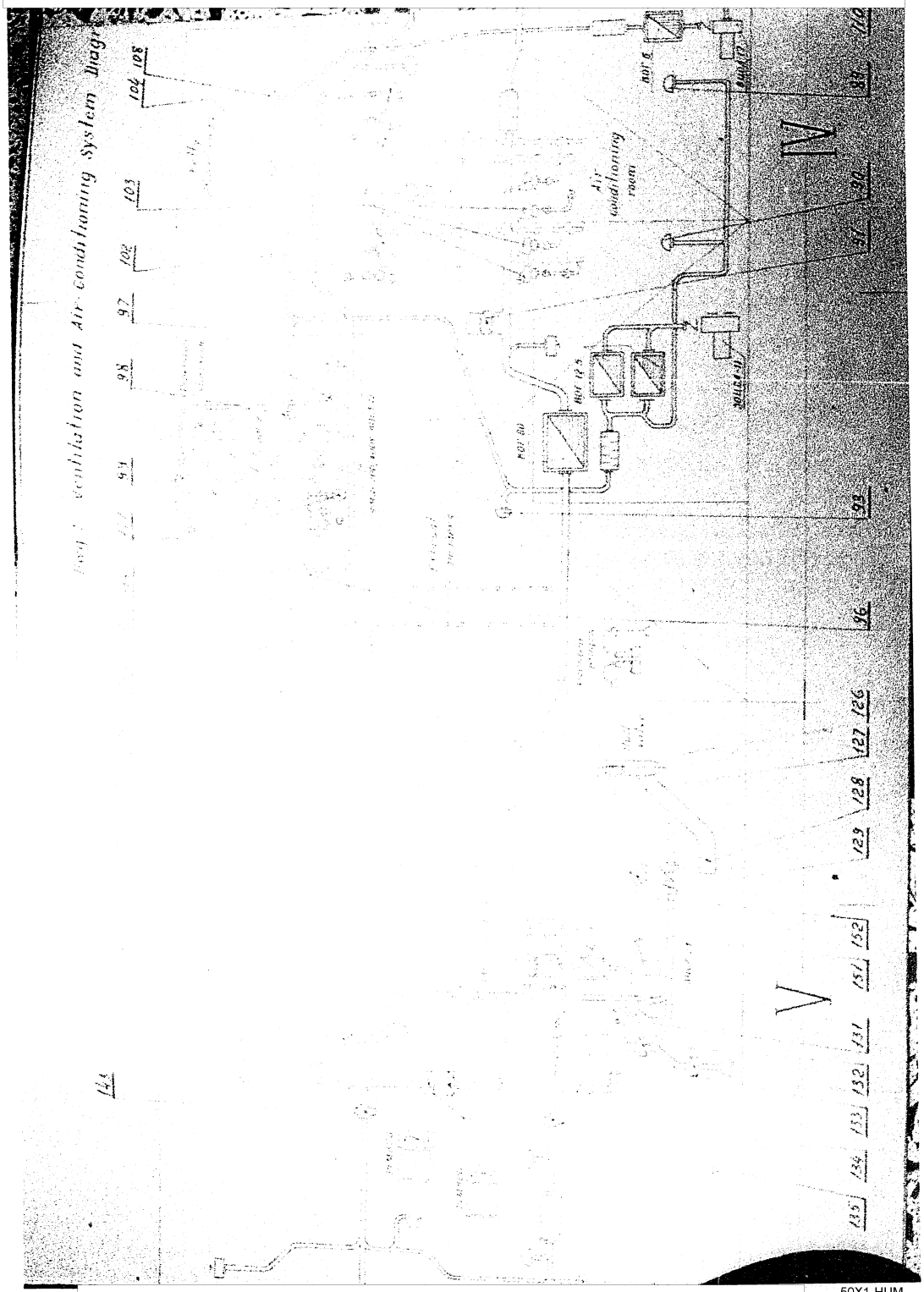

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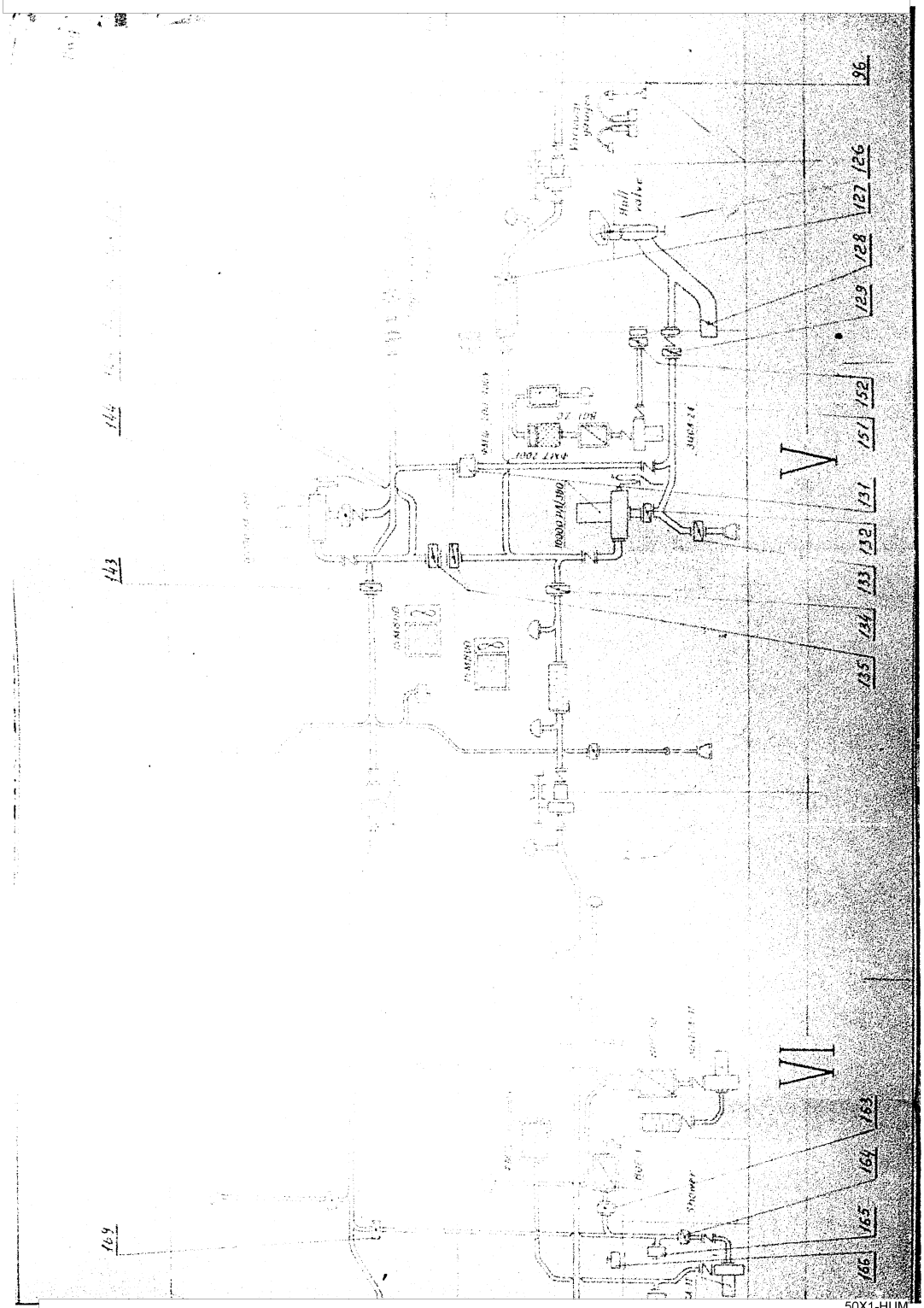

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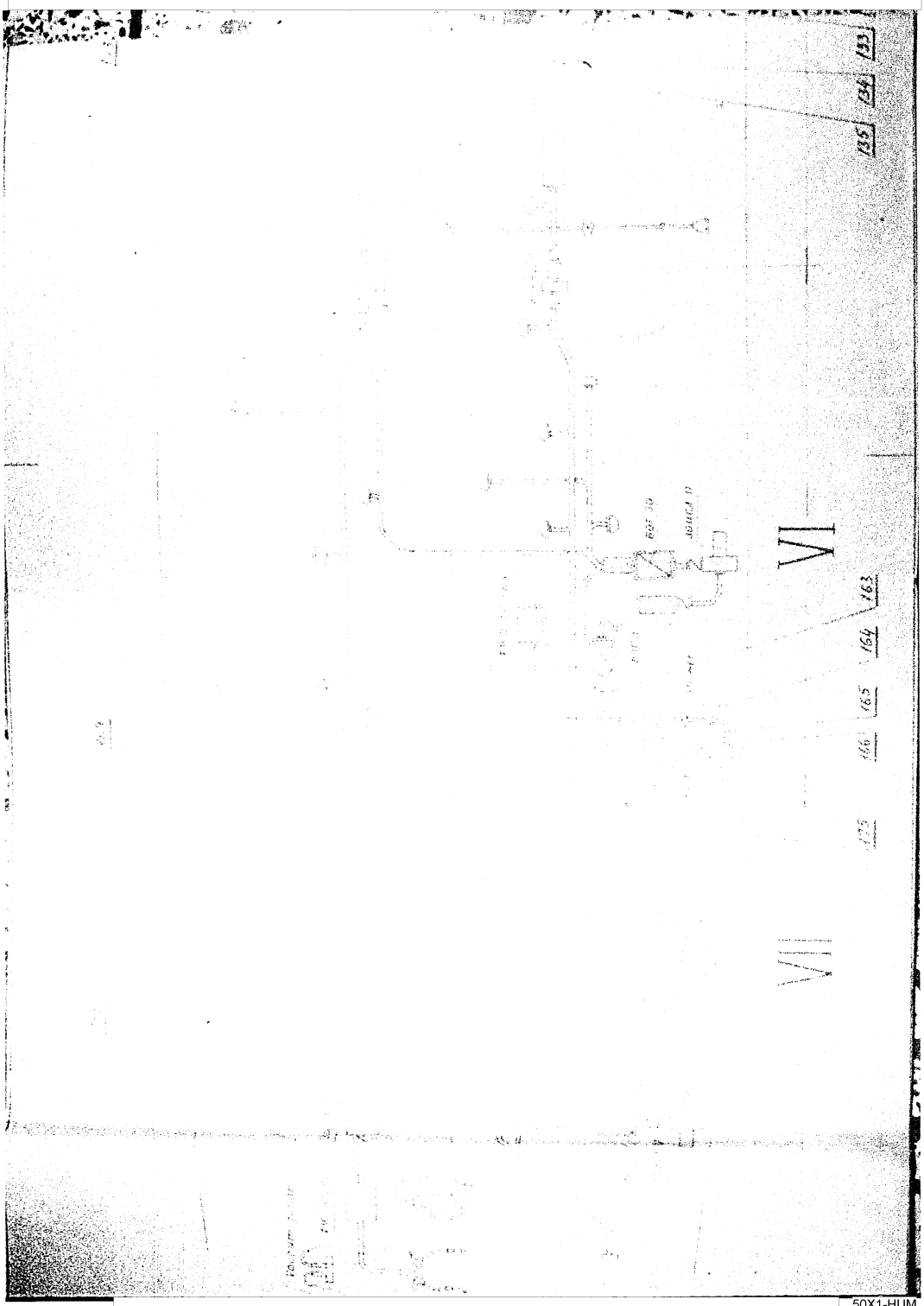

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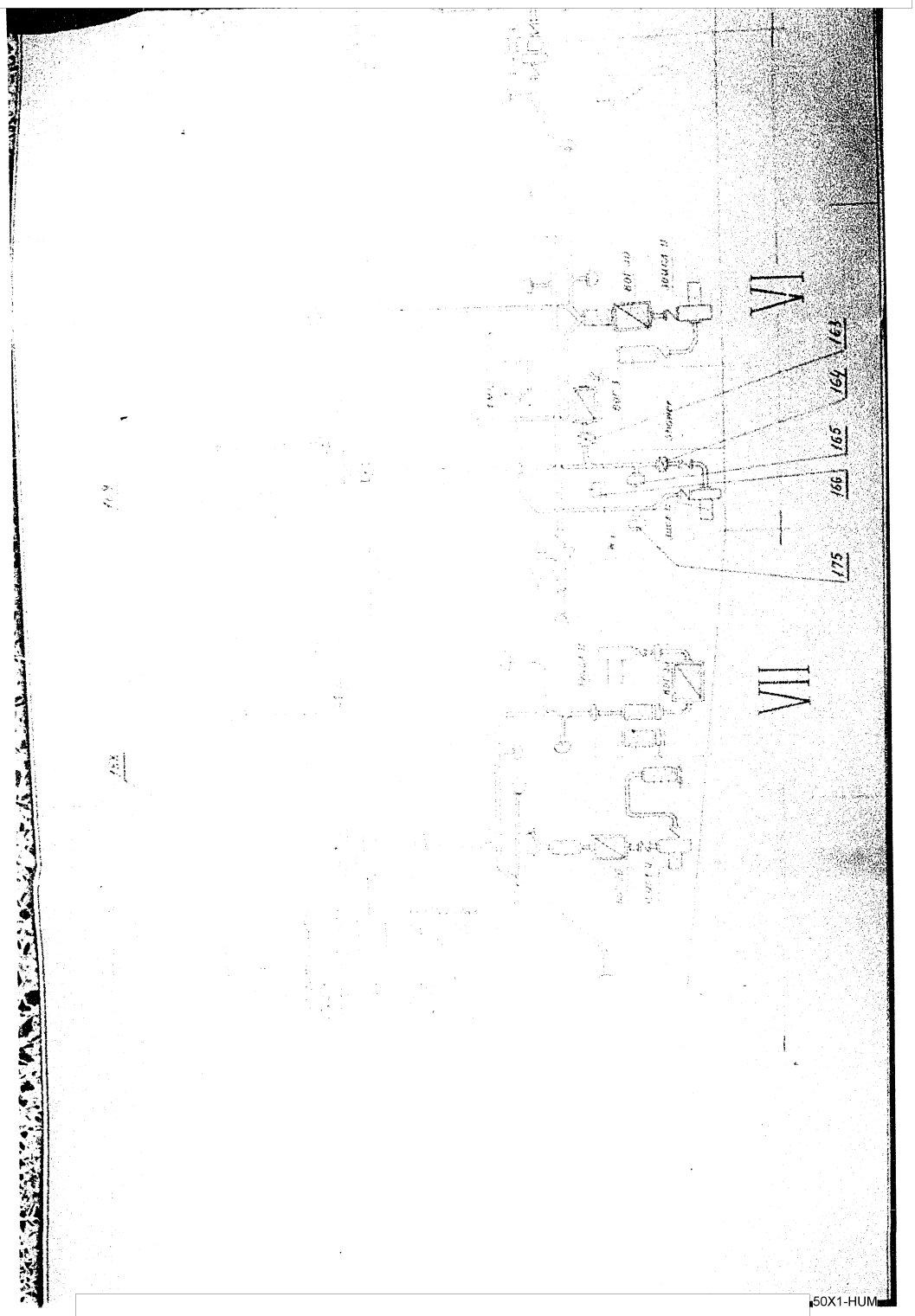

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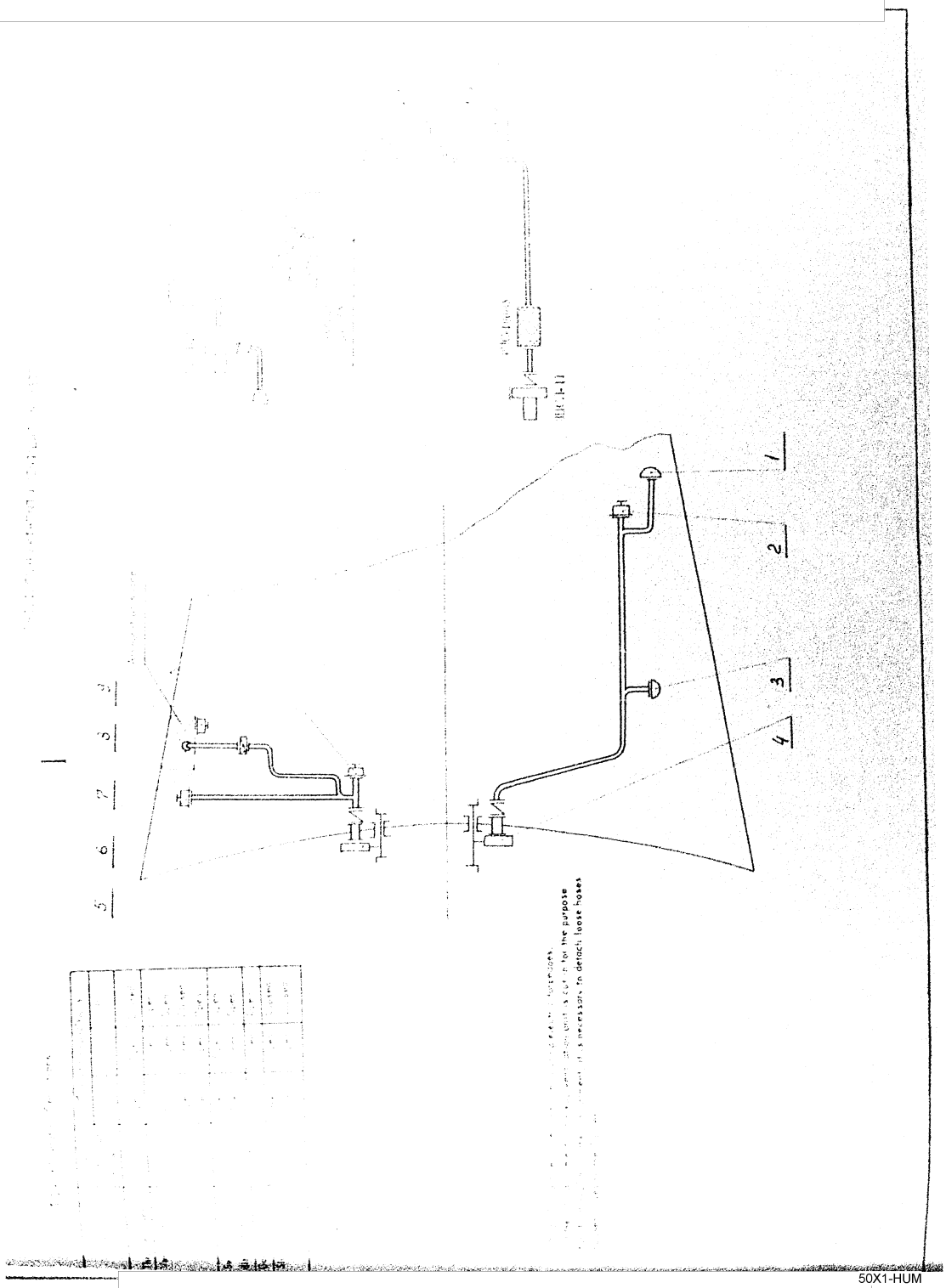

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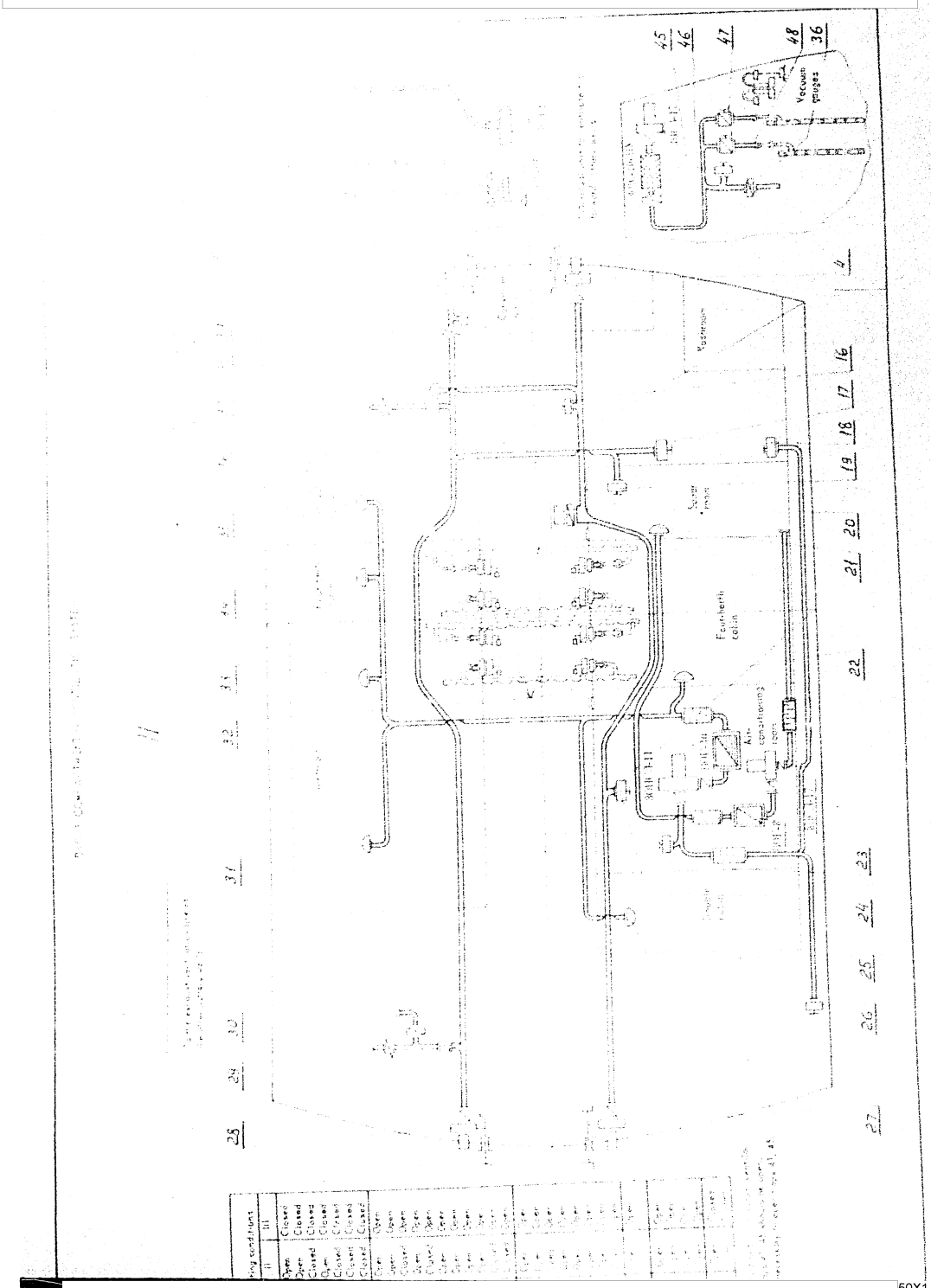

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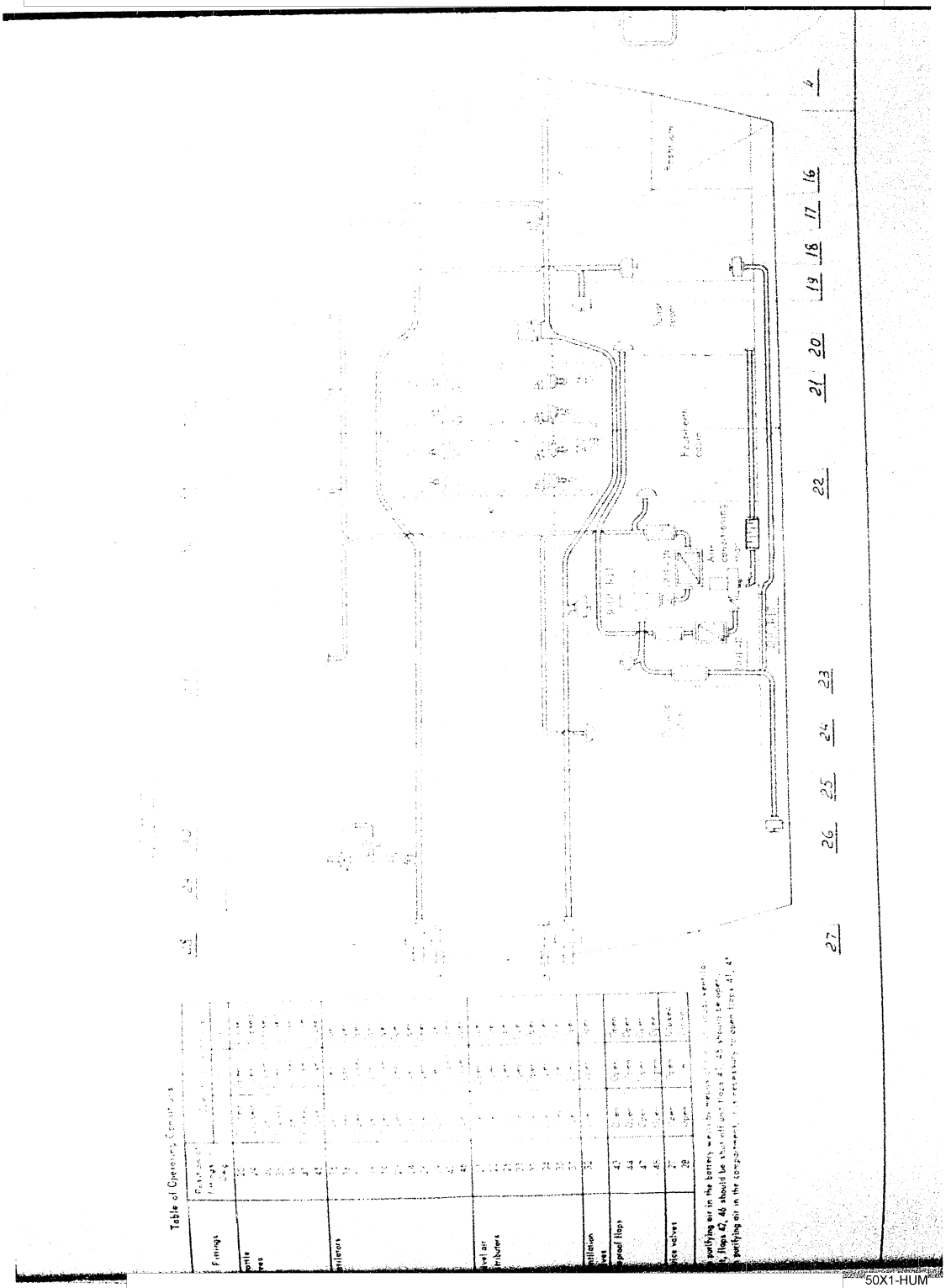

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Table of Operating Conditions

Fittings	Position of Fittings in Diag.	Operating conditions I	II	III
diators	56	Open	Open	Open
	58	Open	Closed	Open
	62	Open	Closed	Closed
	64	Open	Closed	Closed
	69	Open	Open	Open
	72	Open	Open	Open
	73	Closed	Open	Open
	74	Open	Closed	Closed
	76	Open	Closed	Closed
	77	Closed	Closed	Closed
	78	Closed	Closed	Closed
	79	Closed	Closed	Closed
	80	Open	Closed	Closed
	81	Open	Closed	Closed
tal air				
ifolds				
proof floo				
ows				
ste valves				

To ventilate the plane on the ground with engines running, open valves 73, 74, 78.
When the control of the turbo-supercharger system has been established, close valve 62.
While using the A. C. under operating conditions I and II open ventilator 79.
79, under operating condition III open ventilator 79

67 66 65 64 63 62 61 60 59 58 57 56 55 27

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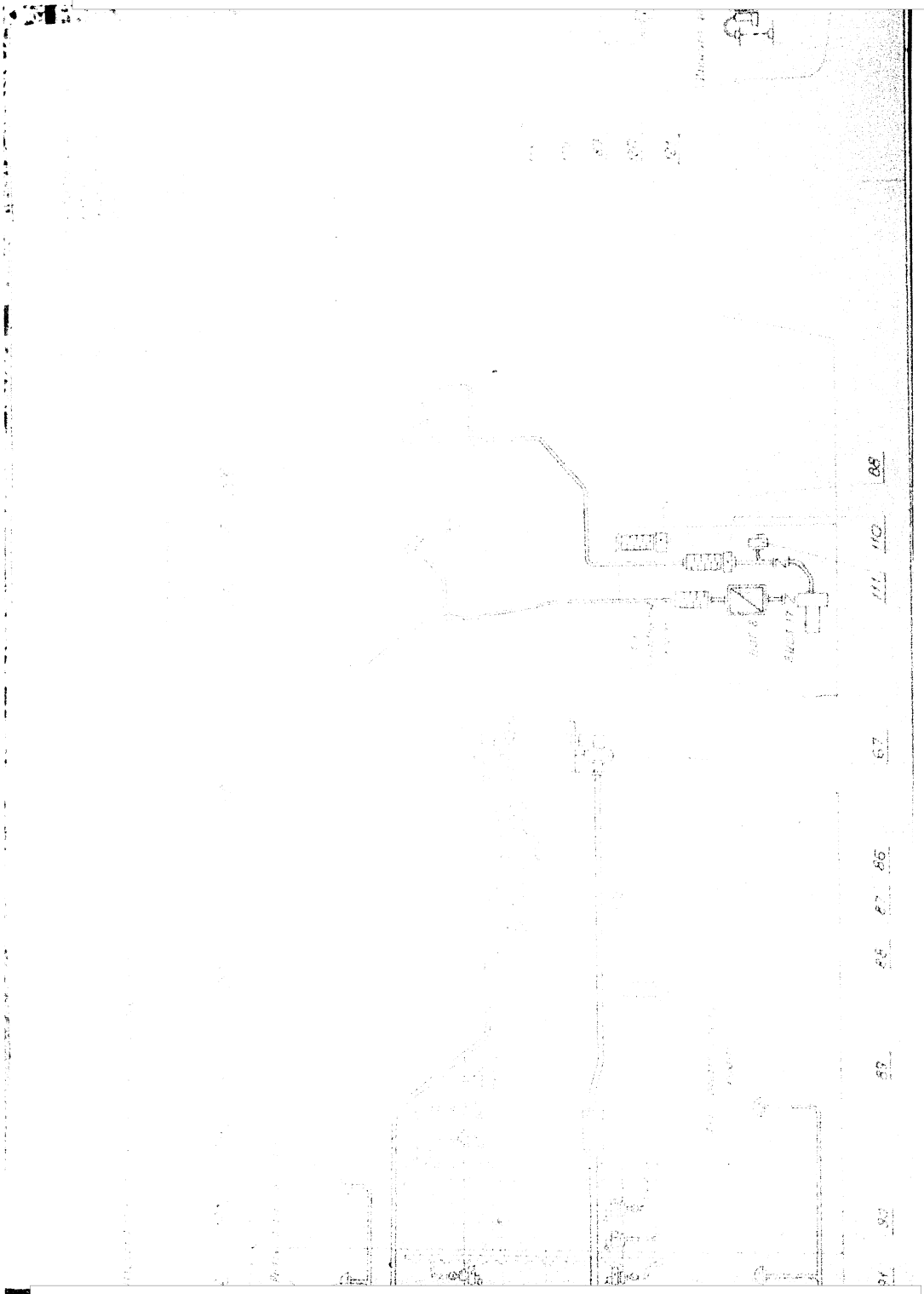

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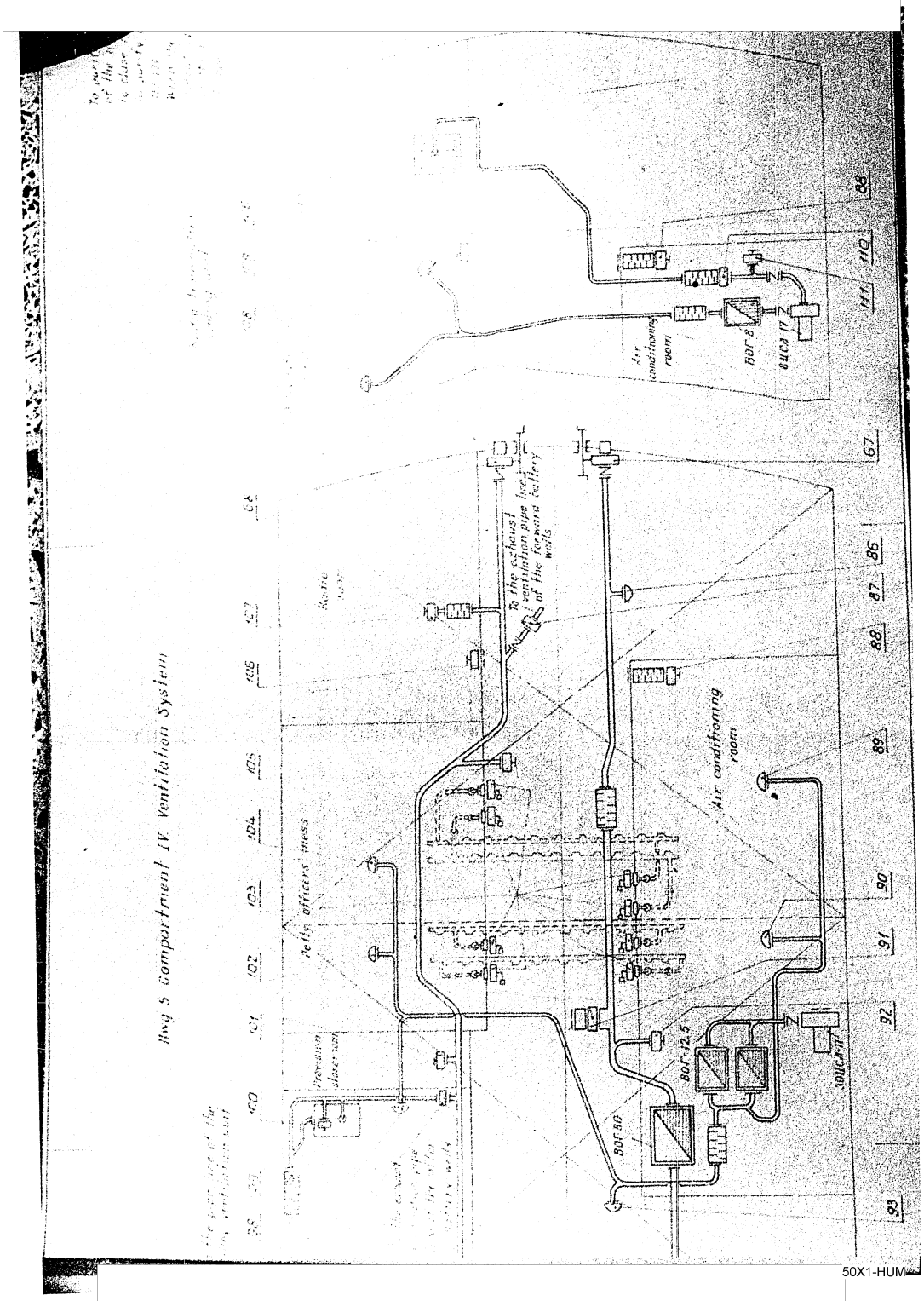

Fig. 5 Compartment IV Ventilation System

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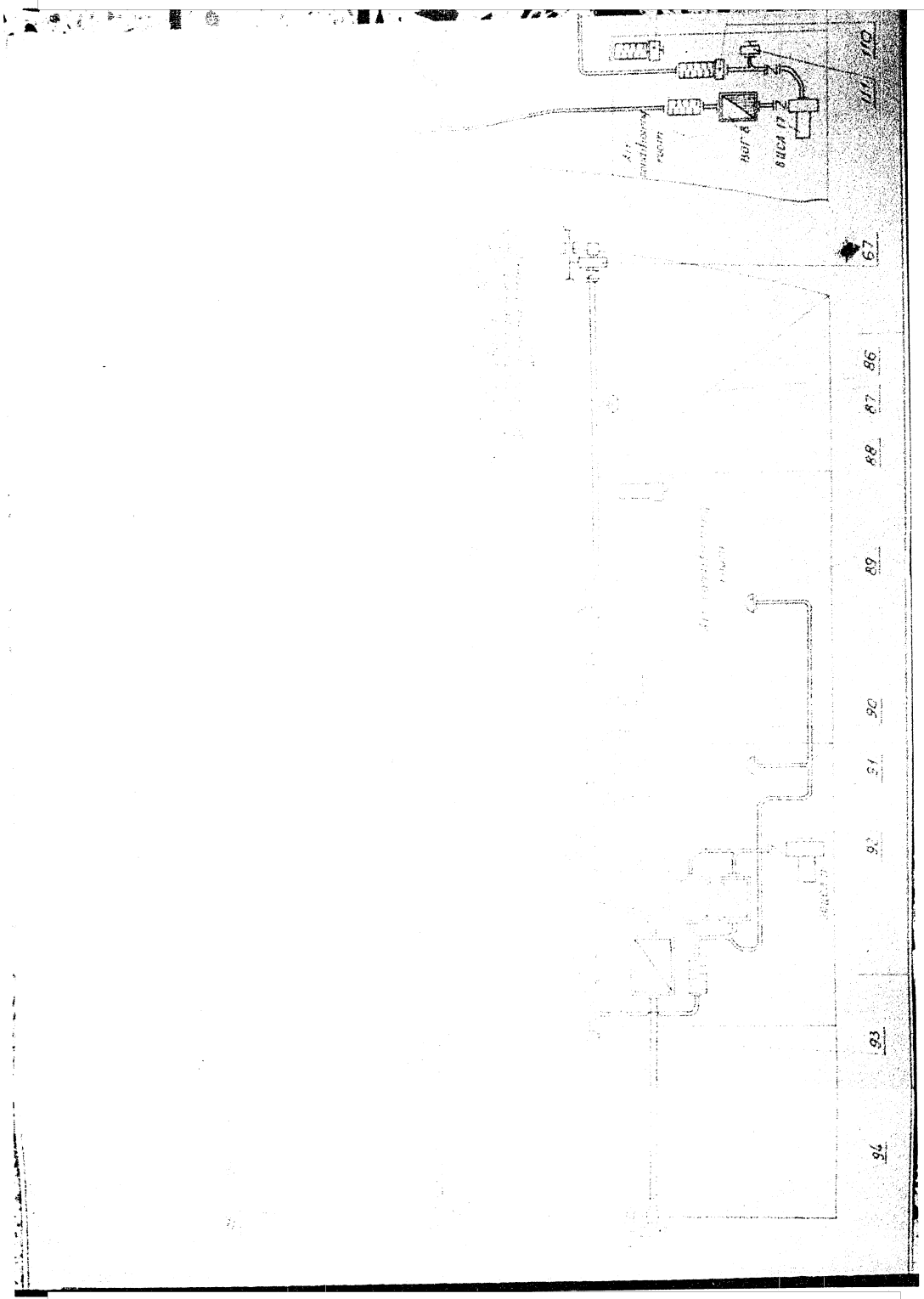

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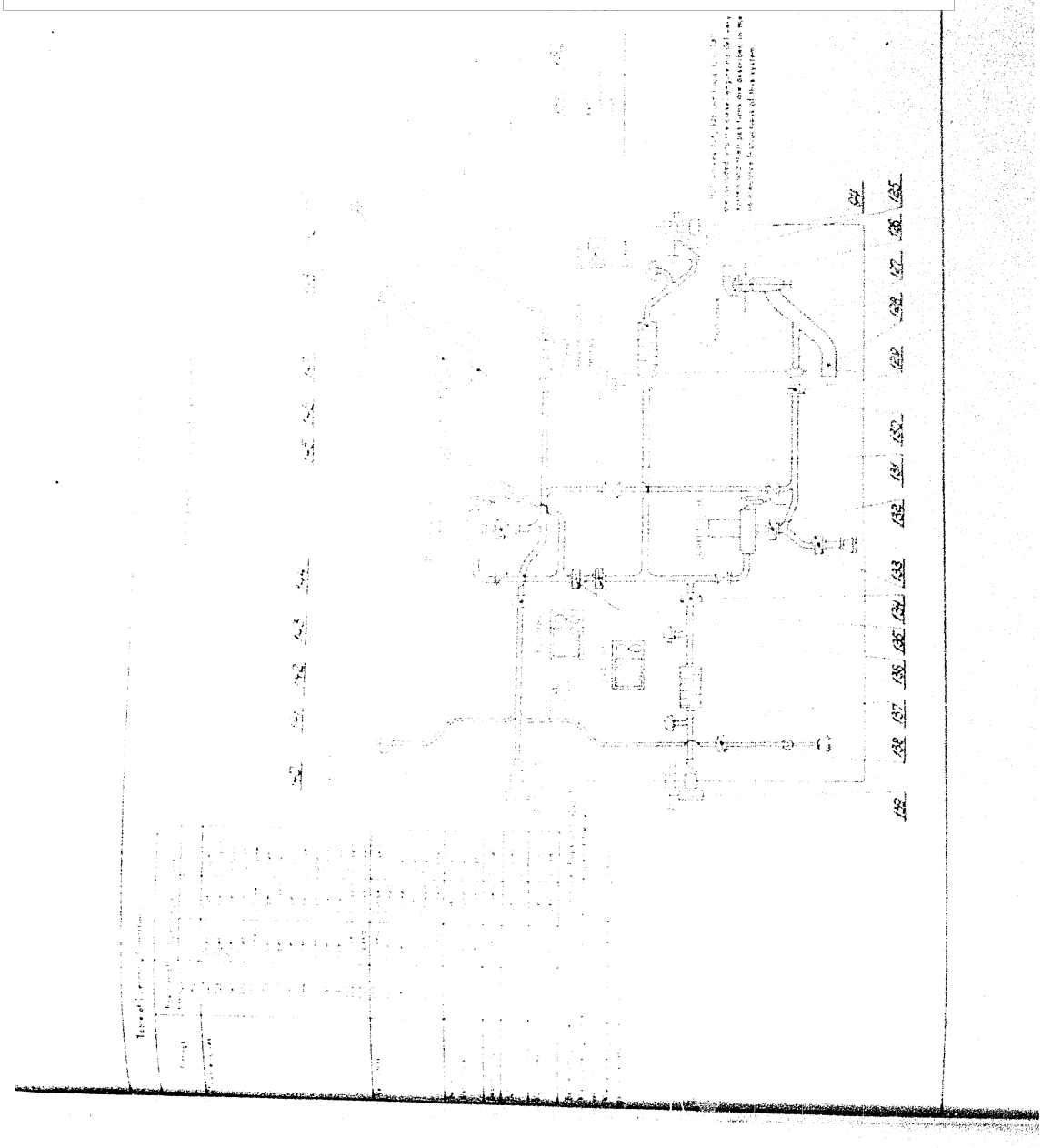

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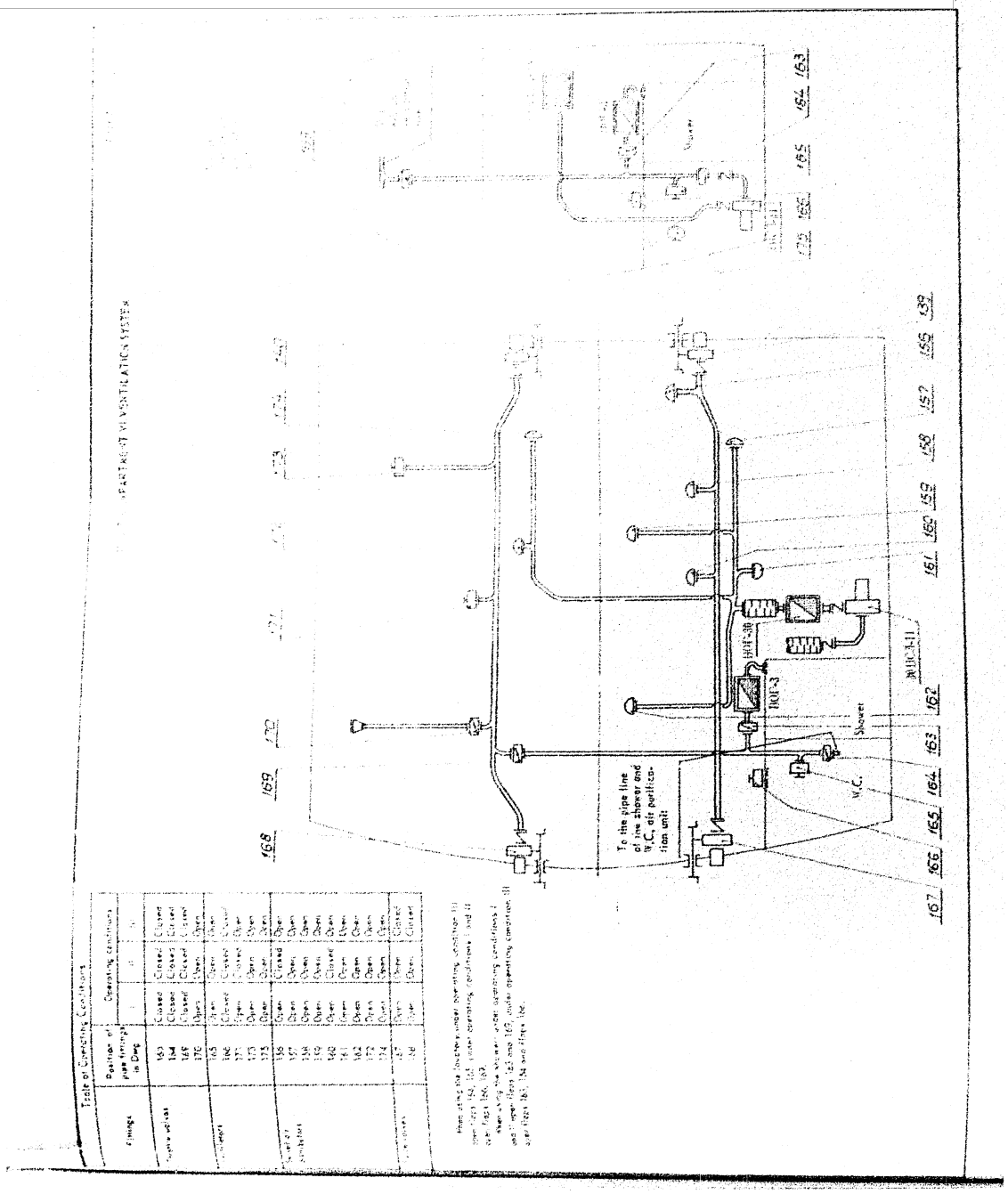

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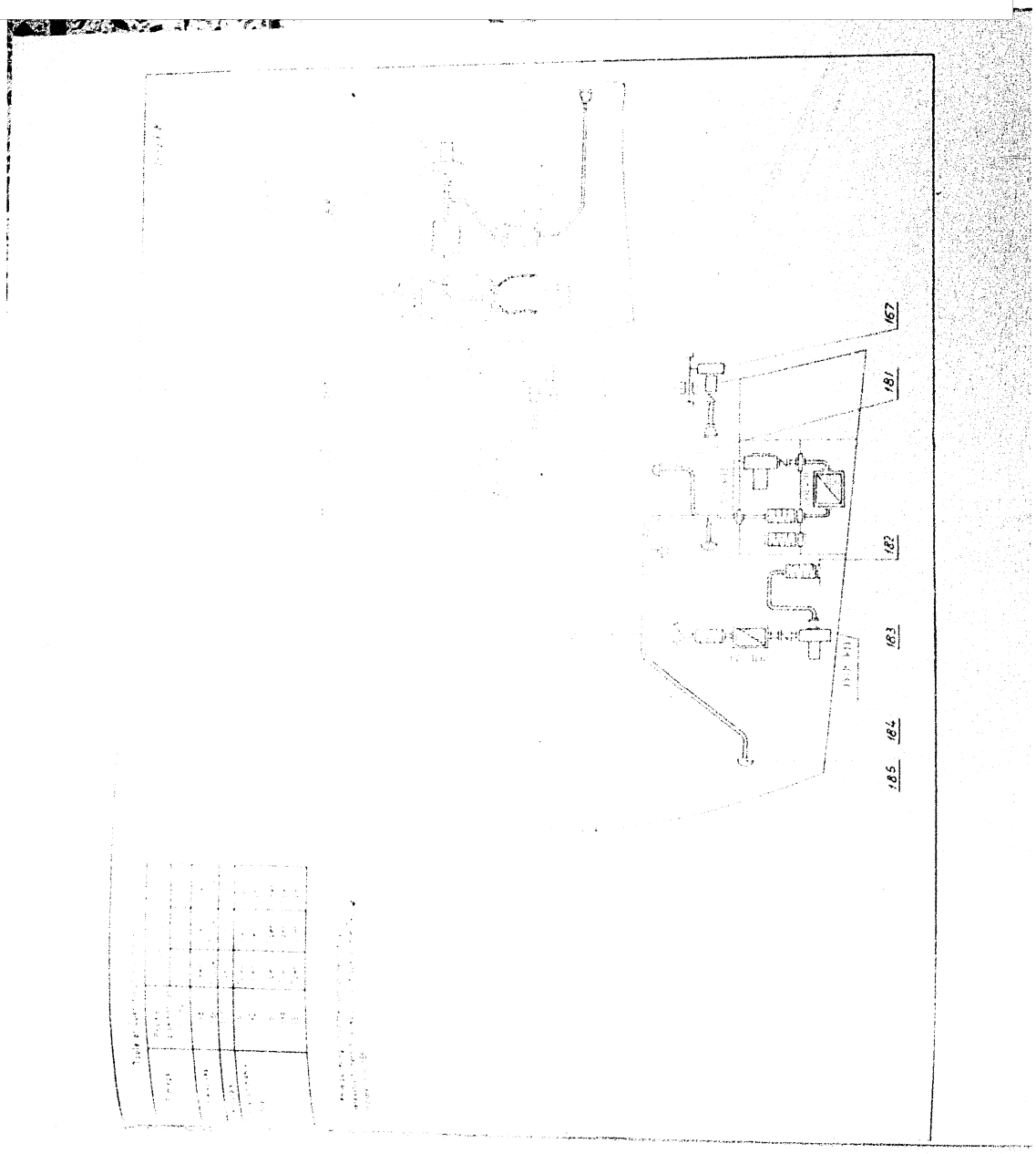

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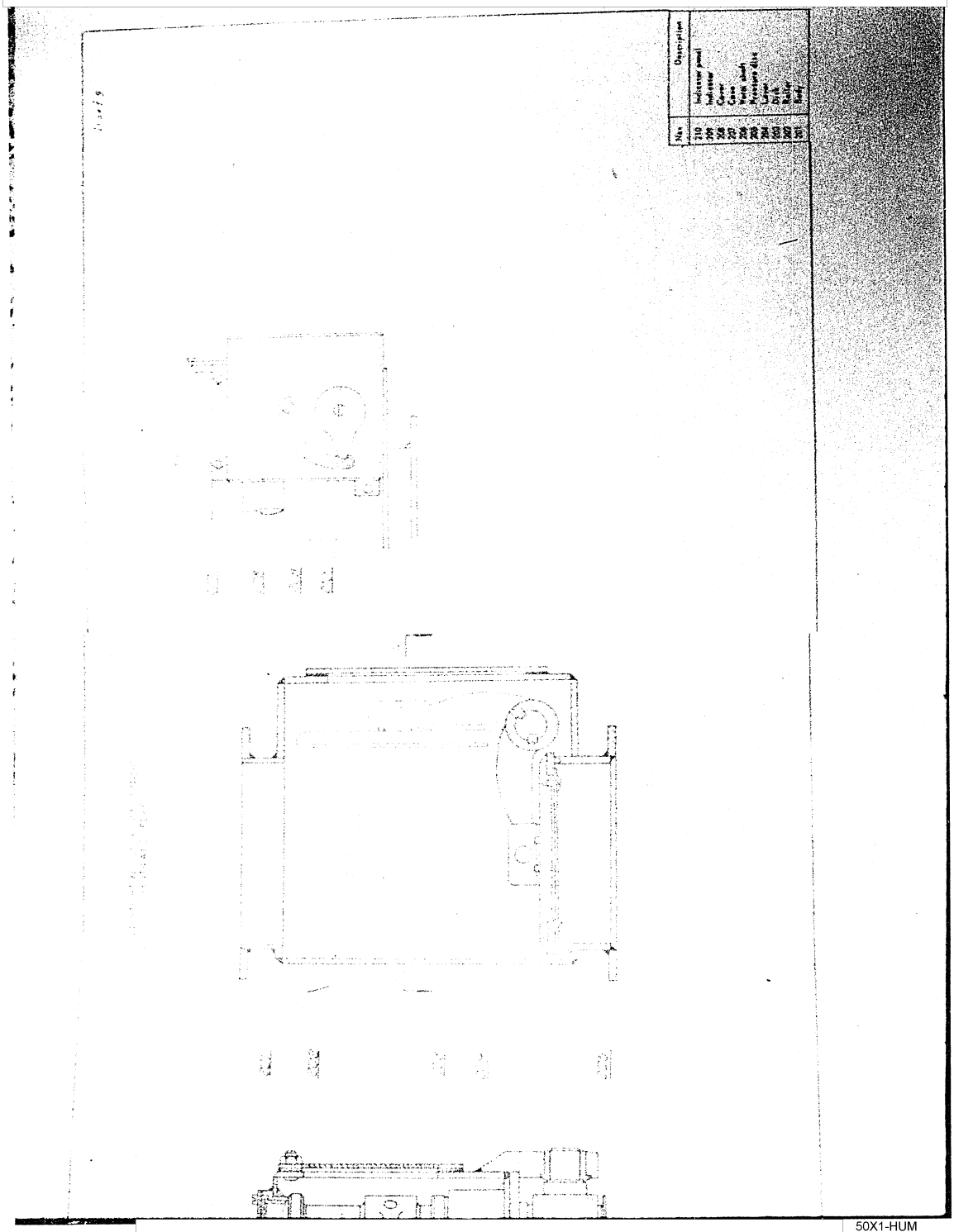

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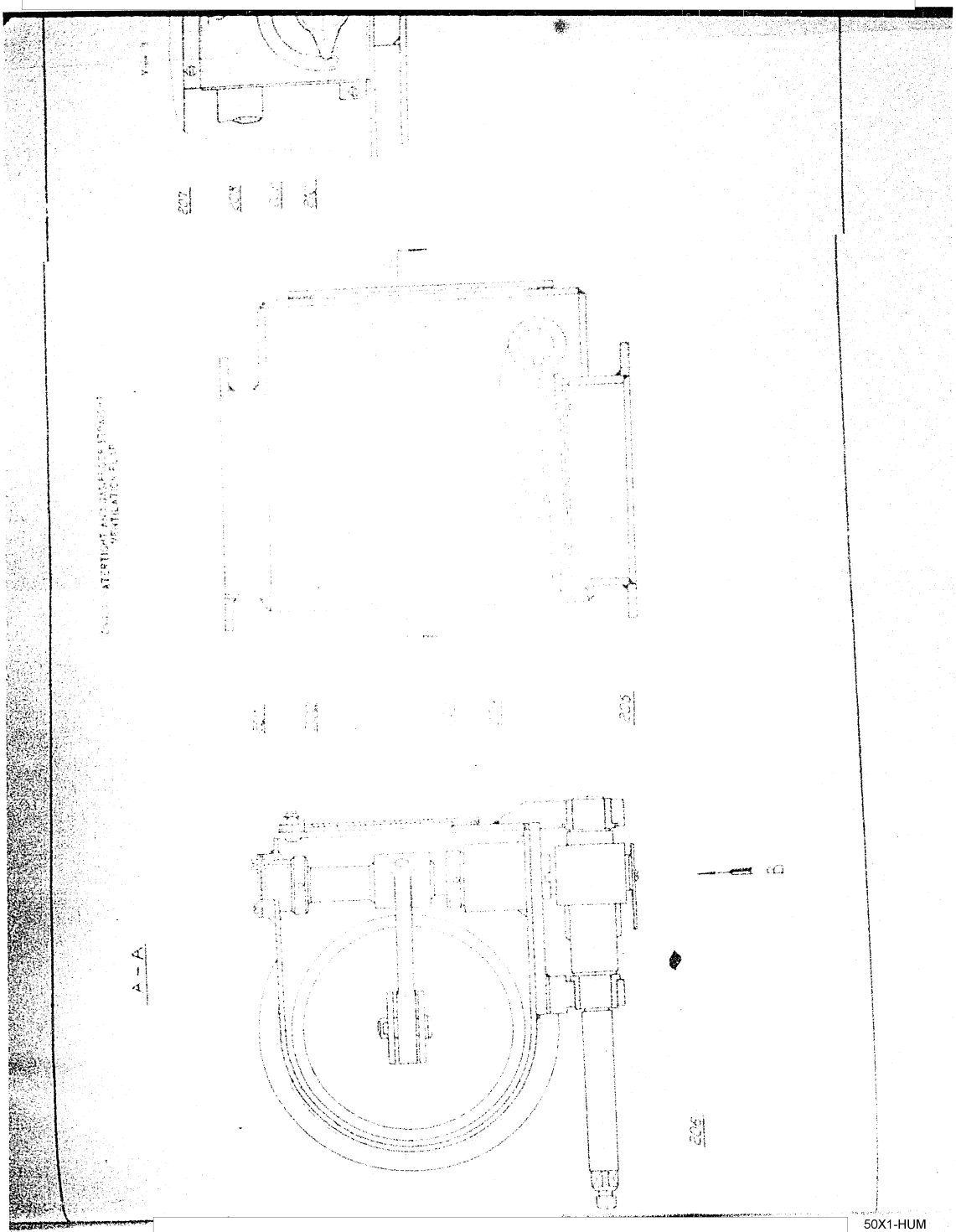

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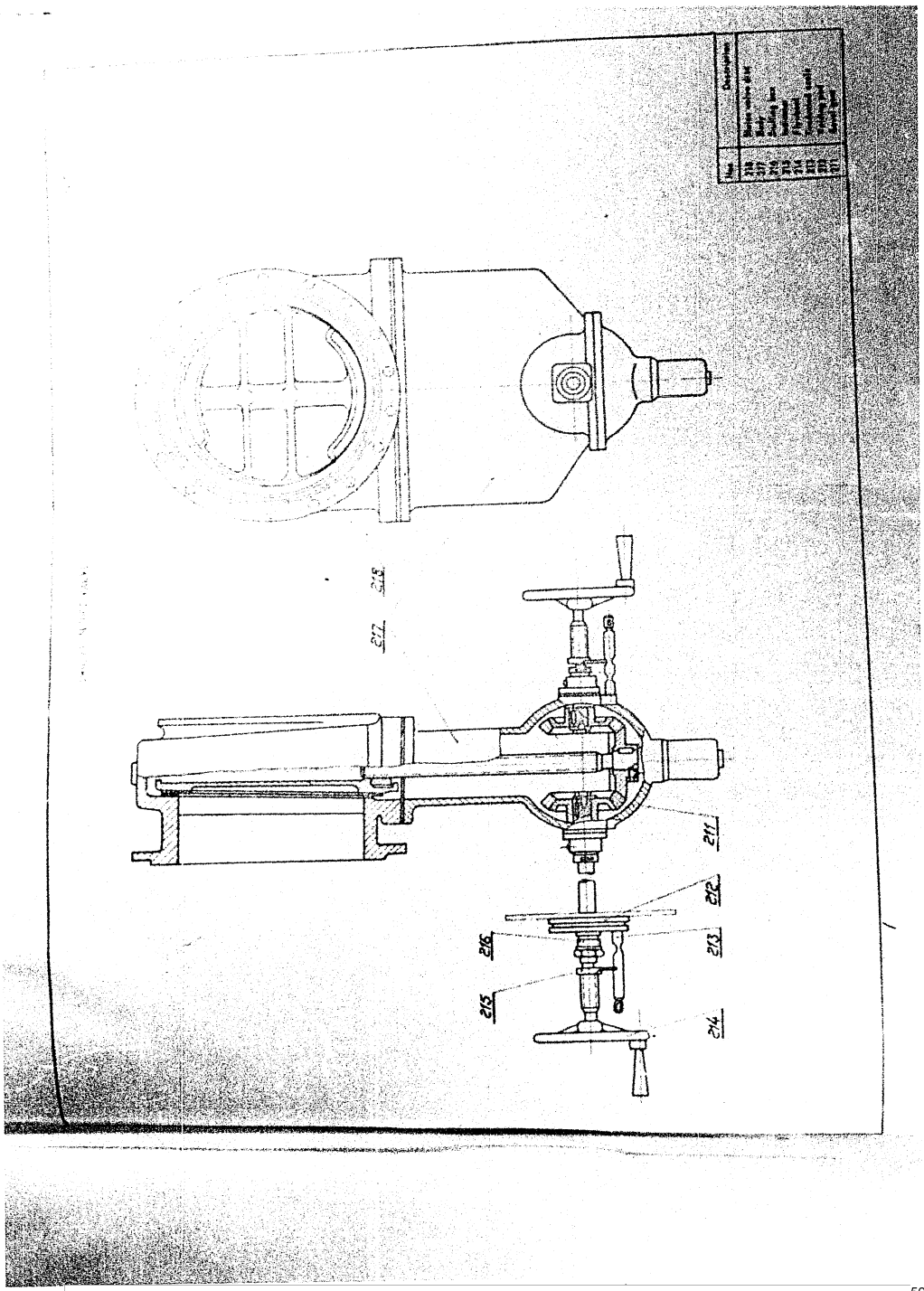

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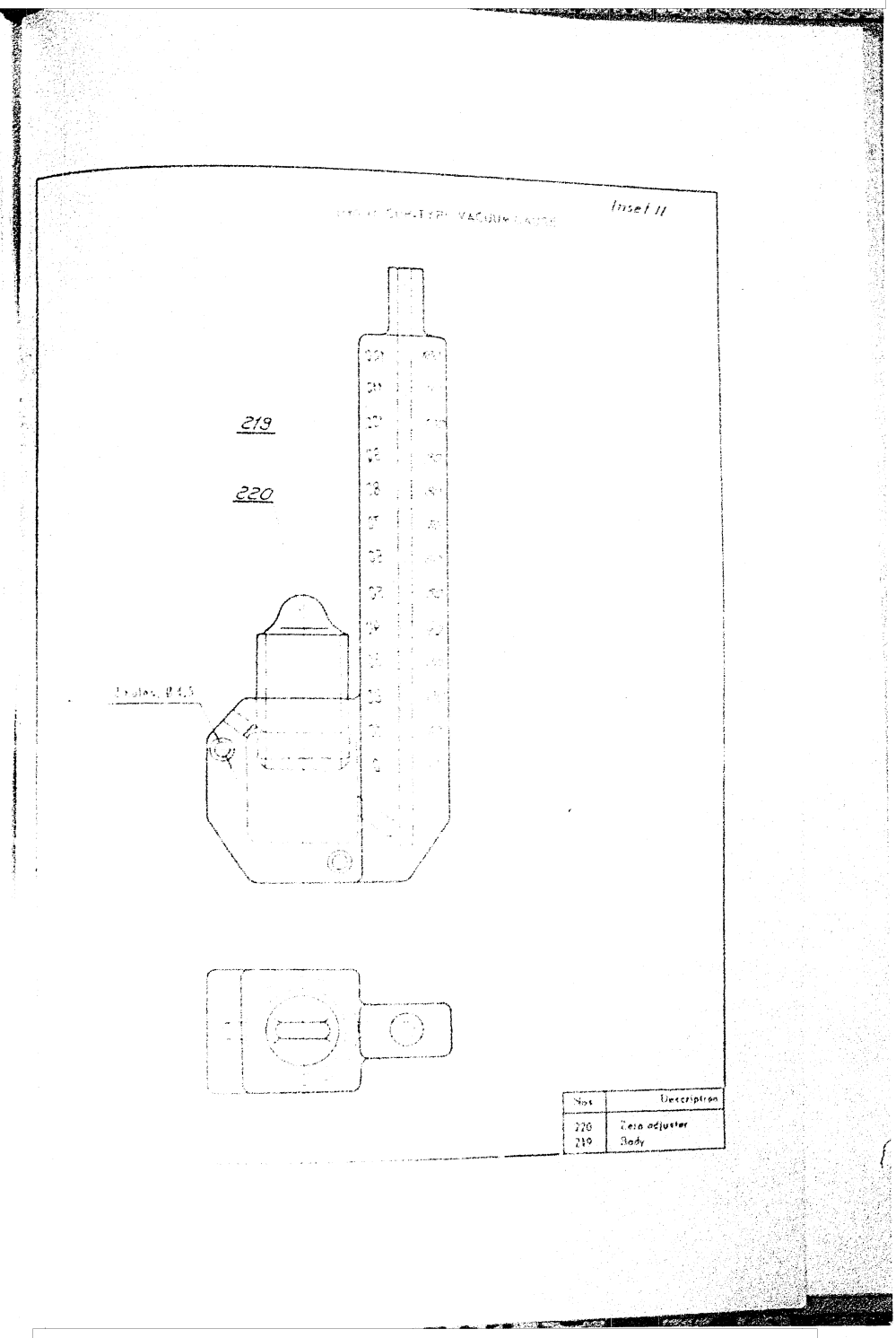

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DIESEL-ENGINE AND SHAFTING OIL SYSTEM

Description and Maintenance Instructions

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I. DESCRIPTION

A. PURPOSE AND BASIC SPECIFICATIONS

The oil system is intended to:

1. Supply oil to the fuel tanks and transfer it to the base or to another ship.

2. Transfer oil from the clean oil tanks to the circulating oil tanks.

3. Supply oil to the diesel-engines when priming them before starting and after stopping them by pumps 5Н (ЭМН 10/5).

4. Supply oil for lubricating the diesel-engines in operation with the aid of the pumps mounted on the engines.

5. Supply oil to the thrust bearings and to the air distributors of the pneumatic clutches.

6. Pump out oil from the diesel-engine crankcases to the circulating oil tanks.

The oil pipe line is worked in steel pipes of the following sizes:

1. [illegible]; 108x5; 89x5; 89x3.5; 76x3; 76x2,5; 57x3; [illegible]; 44.5x2.5. The pipes are flange-connected. The connections are fitted with paronite gaskets.

2. [illegible]; 38x1.5; 38x1.5; 32x2; 25x1.6; 22x2; 14x1.6; 14x1.6. The pipes are connected through the unions furnished with paronite gaskets.

The auxiliary line is worked in red copper pipes, dias [illegible] and [illegible], connected through the unions with paronite gaskets.

The pipes are connected to the pumps through the hose couplings.

The pipes are connected to the diesel-engines through the [illegible] hose couplings.

The fittings are brass with the exception of the steel valves.

For lubricating the diesel-engines and the shaftings, oil М14ГМ is used (See "Diesel Engine 2Д42 Service Manual").

The oil pipe line assembled with the fittings has been [illegible] for tightness.

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The test pressures for tightness are given in the denominators of the fractions standing at the pipes (See Appendix No.1) and in the Section "Preventive Maintenance and Repairs". The service life of the durite couplings is three years.

B. GENERAL DESCRIPTION AND DESCRIPTION OF INDIVIDUAL UNITS

The oil system is arranged in the superstructure in compartments IV, V and VI.

The oil system includes:

(a) four circulating oil tanks and four clean oil tanks. Clean oil tank No.1 is a split tank and is arranged on both sides between frames 70-79;

(b) three oil coolers МХП-22М of diesel-engines 2Д42;

(c) three oil filters of diesel-engines 2Д42;

(d) three centrifugal oil cleaners of diesel-engines 2Д42;

(e) four motor-driven screw-type pumps ЭМН 10/5 (5Н);

(f) electrical oil preheater ПМЭ-500;

(g) three direct-acting temperature regulators РТПДМ-80;

(h) slotted filter of the lubricating line of the shaftings;

(i) oil cooler of the lubricating line of the shaftings;

(j) oil header box;

(k) two hand-operated pumps НР-20 and НР-40;

(l) pipe lines with the fittings.

The stock of the oil to be carried on board the ship is taken into the clean oil tanks whose arrangement and the amount of oil to be taken are shown in the Table below.

Table 1

Nos	Description	Net volume, m^3	Useful stock, tons	Location of tanks, (at frames)	Hydraulic test, kgf/cm^2
1	Clean oil tank No.1	10,2	9.07	70-79, stbd, port	1.5

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Nos	Description	Net volume, m^3	Useful stock, tons	Location of tanks (at frames)	Hydraulic test, kgf/cm^2
2	Clean oil tank No.2	4.84	4.24	89–94, CL	1.5
3	Clean oil tank No.3	4.38	3.9	94–100, stbd	1.5
4	Clean oil tank No.4	2.66	2.36	94–100, port	1.5
Total:		22.08	19.57		

For the location of the circulating oil tanks, their arrangement and the amount of oil taken into them, see Table 2.

[illegible] of clean oil tanks:
[illegible] 275 lit Port 275 lit Total 550 lit
[illegible] lit
[illegible] lit
No.4 70 lit

Table 2

Nos	Description	Net volume, m^3	Amount of oil to be taken	Location (at frames)	Hydraulic test, kgf/cm^2
1	Circulating oil tank No.1 of starboard engine	[illegible]	2.05	83–89, stbd	0.5
2	Circulating oil tank No.2 of port engine	2.85	2.05	83–89, port	0.5
3	Circulating oil tank No.3	2.63	1.75	83–89, CL	0.5
4	Circulating oil tank No.4 of shaft	0.87	0.58	105–106, CL	0.5

Installed in compartment V on the bulkhead at frame 79 are three screw-type motor-driven pumps 5H (ЭМН 10/5). One motor-driven pump 5H (ЭМН 10/5) is installed in compartment VI at frame 107.

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In addition to these pumps, two hand-operated pumps are arranged as follows: type I - in compartment V at frame 83 from the side of the diesel-engines and type III - in the bilge of compartment VI, in the vicinity of the starboard thrust bearing.

The oil header box, capacity 40 lit., is installed in compartment VI, on the bulkhead at frame 107.

Oil is delivered into the oil tanks through filling connections 149 arranged in the superstructure, between frames 80-81, port side and through filling connection 54 arranged in the superstructure, between frames 95-96, starboard side. The filling connections are closed with the threaded covers.

Prior to taking oil into the tanks, the covers shall be removed. When receiving oil by gravity, filling funnels 55 and 140 should be screwed on the filling connections; when filling the tanks with oil under pressure, filling elbows 56 and 151 with hoses 57 and 148 should be screwed on the filling connections.

Filling elbow 151 with hose 148 are used for transferring oil from the tanks to the base or to another ship through filling connection 149.

Filling connection 149 of compartment V through kingston valve 154, valve 153 and three-way cocks 145 and 146 communicates by pipe "a" with circulating oil tanks Nos 1, 2 and 3 through non-return screw-down valves 25, 123, 127 and with clean oil tank No.1 through three-way cocks 164 and 180.

Filling connection 54 of compartment VI through kingston valve 53 and angle valve 52 with the aid of three-way cocks 58, 101, 109 are connected with clean oil tanks Nos 2, 3, 4; and through straight-way cock 73 and non-return screw-down valve 72 with circulating oil tank No.4.

Filling connections 149 and 54 of compartments V and VI are interconnected through pipe "a", which makes it possible to fill all the tanks with oil through two filling connections simultaneously.

The highest points of the filling pipe line "a" mounts cocks, dia. 10, for venting the pipe line in the course of filling.

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Non-return intake valves 165, 181, 111, 61, 99 of clean oil tanks Nos 1, 2, 3, 4 are used to take oil from these tanks.

Clean oil tanks Nos 1, 2, 3 and 4 are equipped with vent [illegible] with cocks 163, 179, 47, 60, 102.

[illegible] oil tanks Nos 1, 2, 3 and 4 mount liquidometers 105, [illegible] to measure the amount of oil in these tanks. Clean [illegible] is equipped with try cocks 162, 166, 167, 175, [illegible] measure the amount of oil in it.

[illegible] oil tanks Nos 1, 2, 3 and 4 are equipped with [illegible]. The ends of the pipes of tanks Nos 1, 2, 3 [illegible], 84, 113 brought to the vicinity of the [illegible] of the diesel-engine blowers.

[illegible], 110 and 86 are provided to measure [illegible] in these tanks.

[illegible] the full stock of oil fed under [illegible] built up by the base pump at a [illegible] is approximately equal to three

[illegible]ation of Oil Pumps

[illegible]board motor-driven pump 5Н of compartment V is used:

[illegible] diesel-engine 2Д42 before starting [illegible], as well as for draining the crankcase of [illegible].

[illegible] oil to circulating oil tank No.1.

[illegible] the oil through the oil preheater when heating

[illegible] may be also used for priming other diesel-engines, [illegible] of the circulating oil tanks, as well as may serve as a stand-by pump used for lubricating the bearings of the shafting in case motor-driven pump 5Н of compartment VI [illegible] defective.

Motor-driven pump 5Н of the centre diesel-engine in compartment V is intended:

1. To prime centre diesel-engine 2Д42 before starting and after [illegible] it and to drain its crankcase.

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2. To replenish oil to circulating oil tank No.
3. To prime oil through the oil [illegible] when heating the oil.

4. The pump may be also used for supplying the diesel-engines, replenishing oil to any of the circulating oil tanks, as well as may serve as a stand-by pump for lubricating the bearings of the shaftings in case pump No of compartment VI gets out of order.

[illegible] motor-driven pump No. of compartment V is used:

[illegible] before starting and [illegible] to operate the engine.

[illegible] circulating oil tank No.2.

[illegible] oil through the oil heater when heating the

[illegible]

[illegible] other diesel-engines, circulating oil tanks, as well [illegible] for lubricating the bearings of [illegible] mounted in compartment VI [illegible].

[illegible]tor-driven pump No. of compartment VI serves:

1. To supply oil for forced lubrication of the thrust bearings.

2. To supply oil for forced lubrication of the aft air distributor of the pneumatic clutch.

3. To feed oil for forced lubrication of the fore air distributor of the pneumatic clutch of the centre shafting with its main propulsion motor in operation.

4. To fill the header box with oil when operating for forced lubrication of the shaftings.

5. To replenish oil to circulating oil tank No.4.

6. The pump may be also used for pumping out oil from the tanks of compartment VI to the base or to another ship.

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As a rule to replenish oil to circulating oil tanks Nos 1, 2 and 3, the oil transfer pumps of the respective engines are used. Oil from clean oil tanks Nos 1,2,3 or 4 through non-return [illegible] valves 1[illegible],181,111,61,99, three-way cocks 164, 180,109, 9[illegible],1[illegible] and loading pipe line "a" enters the suction side of the following pumps:

(a) starboard pump 5H through cocks 8 and 3;

(b) centre diesel-engine pump 5H through cocks 158 and 1;

(c) port pump 5H through three-way cock 146, cock 144 and three-way cock 142;

(d) pump 5H of compartment VI through cocks 73 and 81.

Oil is fed to the circulating oil tanks is effected as follows:

(a) with the aid of starboard pump 5H to circulating oil tank No.1 through three-valve manifold 171, valve 161 along pipe " " through valve 27;

(b) with the aid of pump 5H of the centre diesel-engine to circulating oil tank No.3 through three-valve manifold 171, valve 161, along pipe "6" through cock 16;

(c) with the aid of port pump 5H to circulating oil tank No.2 through three-valve manifold 171, valve 161 and cock 137;

(d) with the aid of pump 5H of compartment VI to circulating oil tank No.4 through three-way cocks 74 and 71.

Note: When taking oil from clean oil tank No.I, see to it that oil from each portion of the tank be consumed gradually, which is effected with the aid of try cocks 162,166 and 167 on the port side and try cocks 175,176,178 on the starboard side. Cocks 182 and 183 on the discharge pipe line after funnels serve for cutting them off from the oil drain pipe line.

The diesel-engines are primed with oil taken from the crankcase by the respective diesel-engine oil transfer pump before starting and after stopping.

Oil is fed as follows:

(a) when priming the starboard engine:

from the crankcase through non-return valve 28, cocks 22 and 3, starboard pump 5H, cock 177, non-return valve 9 and meshed filter to diesel engine;

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(b) when priming the centre diesel-engine:
from the crankcase through non-return valve 120, cocks 130 and pump 5H, cock 141, non-return valve 11[illegible] and meshed filter to the diesel-engine;

(c) when priming the port diesel-engine:
from the crankcase through non-return valve 125, cock 133, three-way cock 143, port pump 5H, cock 147, non-return valve 142 and meshed filter to the diesel-engine.

Note: Cocks 158, 8 and 144 are used to take oil from the clean oil tanks by the motor-driven pumps 5H and to duplicate pumps 5H in case one of them gets defectiv when priming the diesel-engines, the cocks shall be closed.
When in operation, see to it that the handles be removed from these cocks and be secured near them to avoid inadvertant opening of the cocks, thus preventing pumping out of oil from the operating engine oil pipe line.

For priming the diesel-engines with oil from the circulati oil tanks, follow the directions given in Items "a", "b" and "c" for priming the diesel-engines before starting and after stopping the engines. Oil in this case will flow to pumps as follows:

When priming the starboard diesel-engine:
through non-return screw-down valve 25 and cock 3;

When priming the centre diesel-engine:
through non-return screw-down valve 123 and cock 1;

When priming the port diesel-engine:
through non-return screw-down valve 127 and three-way cock 143.

At a temperature of oil in the diesel-engine circulating oil tanks below 20°C, the oil shall be preheated by forcing it through electrical preheater ПМЭ-500 with the help of oil-transfer pump 5H of the engine to be started.

The oil preheater receives only a part of oil, the remaining oil is forced into the pipe line through valve 161.

In this case oil flows as follows:

(a) when preheating oil in circulating oil tank No.1: through non-return screw-down valve 25, cock 3, starboard pump 5H, three-valve manifold 171, valve 161 and cocks 166, [illegible] 27 to the tank;

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(b) When preheating oil in circulating oil tank No.3: through non-return screw-down valve 143, cock 1, centre diesel-engine pump 5H, three-valve manifold 171, valve 161, cocks 168, 174 and 16 to the tank;

(c) when heating oil in circulating oil tank No.2: through non-return screw-down valve 137, three-way cock 143, port pump 5H, three-valve manifold 171, valve 161 and cocks 168, 174 and 157 to the tank.

[illegible] the diesel-engines with oil from the crankcases [illegible], in case the temperature of oil in the crankcases [illegible], the oil preheated in the electrical preheater in [illegible] the directions outlined in Items "a", "b" and [illegible] the oil in the circulating oil tanks. In this [illegible] the suction side of the 5H pumps through cocks [illegible] through non-return screw-down valves 25, [illegible].

[illegible] the oil to the oil preheater through three-[illegible] and then through cock 174, valve 161 [illegible] for priming the respective engine.

[illegible] with preheated oil as well as [illegible] in the circulating oil tanks may be effected in turn only.

[illegible] compartment 7 is used:

[illegible] for washing and for other purposes through cock 4;

(b) to pump out used oil from the circulating oil tanks of the diesel-[illegible] through pipe unions 34, 121 and 128 which are connected [illegible] on the suction side of the pump through the pipe union of three-way cock 8; through three-way cock 5 oil is pumped out to a vessel, collecting oil tank or to the base.

Oil is supplied to the base through the pipe union of cock 134, valve 131 and Kingston valve 152. To pump out used oil from the circulating oil tank overboard or to the base with the aid of port pump 5H of compartment 7, the hoses are connected to the pipe unions of cocks 154, 143, 157 and to respective pipe unions 34, 121, 128 and 34 on the circulating oil tanks.

Each diesel-engine mounts two pumps: delivery pump and scavenge pump.

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The delivery pump is used to take oil from the circulating oil tank through non-return intake valves 29, 32, 124 and to feed it through the meshed filter to the diesel-engine.

Part of oil is fed through valves 26, 30 and 122 to the centrifugal cleaners, the other part of oil through valves 41, 45, 112 and reducing valves 43, 46 and 110 adjusted at a pressure of 2.0 kgf/cm^2 is fed to the fore air distributors.

The recovery pump is used for pumping out the oil from the diesel-engine crankcase to the circulating oil tank through the meshed filter, cooler or past it to the thermoregulator.

To feed oil to the shafting, motor-driven pump 58 of compartment VI takes oil from circulating oil tank No.4 through non-return screw-down valve 74, cock 81 and delivers it through three-way cock 84, the clinker filter, oil cooler to the thrust bearing through valves 94, 96, 98, to the aft air distributors of the pneumatic clutches - through cock 65 and valves 65, 97, 99; to the fore air distributor of the pneumatic clutch of the centre shafting - through cock 67 and valve 91 and to the header box through cock 63.

From the thrust bearing oil is drained through cocks 67, 69, 71 to circulating oil tank No.4; oil from the pans of the thrust bearing is drained through cocks 66, 68, 91.

Oil from the aft and fore air distributors of the pneumatic clutches is drained through the open funnels respectively to circulating oil tanks Nos 4, 1, 2.

With the propulsion motor in operation oil from the fore air distributor of the pneumatic clutch of the centre shafting is drained through the funnel and the pipe with cock 103 to circulating oil tank No.4. With the diesel-engine in operation, oil is drained through cock 49 to circulating oil tank No.3.

Oil from the header box is consumed by gravity through cock 83 and valve 96 for lubricating the aft air distributor of the pneumatic clutch of the centre shafting with the endurance motor in operation.

The tank is vented through the open vent pipe with a funnel into the bilge.

Oil is drained from the tank through cock 80 and the vent pipe to circulating oil tank No.4.

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The hand-operated pump of compartment VI is connected in parallel with motor-driven pump 5H of compartment VI and is used:

(a) to fill the header box through non-return screw-down valve 73, three-way cocks 76 and 75, slotted filter, oil cooler and cock 82;

(b) to strip circulating oil tank No.4 through pipe union 88 with a hose connected to three-way cock 76 and to pump out the oil through three-way cock 75 to a portable vessel or through a hose to the base.

Motor-driven pumps 5H of compartments V and VI are connected through the pipeline that the pumps of compartment V can supply from the pump of compartment VI in lubricating the [illegible].

[illegible] pump of compartment V operates for lubricating [illegible], simultaneous replenishing of oil in the circulating oil tanks or preheating [illegible] and in the crankcases of the [illegible] the oil of the other pumps of compartment [illegible] possible.

Specifications of individual units.

Motor-driven Pump 5H (3MH 10/5)

[illegible] 20 V at 1500 r.p.m. is 10 m^3/hr.

[illegible] at suction at suction is 5 m H_2O (370 mm Hg).

Working pressure at high pressure side-5 kgf/cm^2.

The pump is engaged from the mains when pumping the oil when the diesel-engines at a temperature of 20°C, 220 V - [illegible] kw.

Hand-Operated Pumps

Pump HP-40 output at double-strokes of 42 per minute is 40 lit/min.

Discharge pressure - 40 m H_2O.

Suction lift - 5 m H_2O.

Pump HP-40 output at double-strokes of 28 per minute is 35 lit/min.

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Discharge pressure - 30 m H_2O.
Suction lift - 5 m H_2O.

Centrifugal Cleaner

This is installed in the oil system on the discharge mains of the diesel-engine scavenge pump. The cleaner is used for fine filtration of the oil. For description of construction and principle of operation, see "Diesel-Engine 2D42. Service Manual

Oil Catcher
(See Appendix 2)

Oil catchers 43, 44 and 113 are mounted on the vent pipes of the diesel-engine circulating oil tanks. They are used to prevent oil vapours from getting into the diesel-engine compartment.

For higher effectiveness of catching the oil vapours, the oil catchers are installed [illegible] the suction branch pipes of the diesel-engine [illegible]

[illegible] on the framing 201, [illegible] on the framing in [illegible]

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No. on schematic diagram	Designation	Type of instrument	Nominal range (limit) value	Installation	Re-
1	2	3		5	6
79, 156, 160, 173	To measure pressure at suction side of pump 5B. Pressure gauge	[illegible]	[illegible]	On instrument panels of pump 5B in the vicinity of diesel-engine control station, port side	
78, 156, 159, 172	To measure pressure at discharge side of pump 5B. Pressure gauge	MTK-1005x10, accuracy grade 2.5	[illegible] kgf/cm²		
169, 170	To measure pressure at inlet and outlet of oil preheater ПМ3-500 Pressure gauge	MTK-1005x 6/4, accuracy grade 2.5	2-3/4 kgf/cm²	On instrument panel of oil preheater ПМ3-500 on bulkhead at frame 79	

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1	5	6
33, 115, 117		
12, 17, 15, 17, 130, 193		On instrument panel of diesel-engines engine vicinity of diesel-engine control station recess, or bulkhead at frame 63
23, 129, 134,	To measure pressure before diesel-engine inlet. Pressure gage 1.5	
20, 135, 136	To measure pressure before filter on mains of diesel-engine delivery pump.	MM-100Bar, accuracy grade 2.5

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1	2	3	4	5	6
48, 107, 108	To measure pressure of oil to air distributor of fore pneumatic clutch. Pressure gauge	MTK-100B: [illegible], accuracy grade 2.5	0.5-1.[illegible] kgf/cm^2	In forward panel of aft [illegible] pneumatic clutches on bulkhead at frame 94, from the side of compartment V	
62, 93, 96	To measure pressure of oil to air distributor of aft pneumatic clutch. Pressure gauge	MTK-100B: 4x2.7, accuracy grade 2.5	0.5-1.3/[illegible] kgf/cm^2	Pressure gauge [illegible] to measure pressure of oil to air distributors of aft pneumatic clutches and to thrust bearings between frames 99-100	
63, 87, 94	To measure pressure of oil to thrust bearing. Pressure gauge	MTK-100B: 4x2.7, accuracy grade 2.5	0.2-0.5/0.5 kgf/cm^2		

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1	2	3	4	5	6
14, 18, 133	To measure temperature of oil at diesel-engine outlet. Thermoelectrical set	[illegible] 0-100°C	For oil temperature, see "Diesel-Engine 2D42. Service Manual"	Indicating instrument in the vicinity of diesel-engine control station, starboard	
19, 21, 131	To measure temperature of oil at diesel-engine inlet. Thermoelectrical set	[illegible] 0-100°C	50-55°C/60°C	Indicating instrument in the vicinity of diesel-engine control station, starboard	
50, 104, 106	To measure temperature of oil at outlet of the air distributor of the fore pneumatic clutch. Temperature alarm	CMKT-I-022 0-100°C	45-60°C/65°C	Indicating instrument between frames 104-105, CL	
64, 92 95	To measure temperature of oil at outlet of air distributor of aft pneumatic clutch.	CMKT-I-022 0-100°C	45-60°C/65°C	Indicating instrument between frames 104-105, CL	

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1	2	3	4	5
To measure temperature of oil in circulating oil tanks Noc 1, 2 and 3. Thermoelectrical set	[illegible] (-1000	[illegible]	Indicating instrument in the vicinity of diesel-engine control station, starboard	

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The oil system of each engine is equipped with the oil overheating and oil pressure drop alarm systems.

For this purpose the branch pipes running from the pressure line of the delivery pump of the diesel-engine mount two pipe unions each after the filter to connect the pick-ups of the pressure relays, while the pressure pipe line of the scavenge pump mounts a pipe union before the filter to connect the pick-up of the thermal relay.

One of the pressure relays is intended to supply a warning light signal when oil pressure reduces, while the other relay switches on the protective device which will stop the engine in case of emergency drop in oil pressure.

Protection in oil pressure drop will operate only when the diesel-engine operates with the automatic remote control system.

The thermal relay is meant to produce a warning light signal in case oil gets overheated.

For the detailed description of the alarm and protective systems of the diesel-engines, see the "Description and Operating Instructions for Automatic Remote Control of 2Д42 Diesel-Engines".

Cocks [illegible], 116 and 118 are used for regular checking the alarm system and emergency stopping of the engines in case the pressure of oil in the diesel-engine oil supply lines drops. When the diesel-engines are in operation, cocks 34, 36 and 116 are sealed in the open position, while cocks 37, 39, [illegible] are sealed in the shut off position.

To carry out checks, connect the test pressure gauges to the pipes running from cocks 36, 40 and 114, start the engines and after the pressure of oil in the diesel-engines has risen, close cocks 34, 36 and 116. Then done, slowly crack cocks 37, 39 and 118, relieve pressure from the pick-up pipe lines, watch the pressure reading of the test pressure gauge at which the alarm and the protection systems operate. For the terms to carry out the checks, see the "Description and Operating Instructions for Automatic Remote Control System of 2Д42 Diesel-Engines".

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The discharge pipe line of motor-driven pump 5H of compartment VI mounts the pressure relay which sends light and sound signals in case pressure of oil in the shafting lube oil system pipe line drops. The oil pressure drop signal is sent by the bell whose casing houses a red lamp. The bell is arranged in compartment VI, starboard, in the vicinity of shafting [illegible].

11. [illegible]

[illegible] system of the diesel-engines and of the [illegible] readiness for action:

[illegible] the flanged and union connections of [illegible] and packing of the fittings to make sure [illegible] In case leakage is detected, replace [illegible] the joint; tighten up the gland packing or [illegible].

[illegible] that the fittings are in good order.

[illegible] filters and the strainers of the diesel-engines [illegible] in accordance with the "Diesel-Engines 2Д42.. Service [illegible]".

[illegible] not less than once in four hours clean the slotted filters of the lube oil system.

[illegible] (once a year) clean all the tanks from [illegible] and simultaneously flush the non-return intake and the non-return screw-down valves.

5. When replacing oil in the oil circulating tanks, clean [illegible] valves of the non-return screw-down valves and those of the [illegible].

[illegible] FILLING AND STARTING THE SYSTEM

(a) Initial Position

1. Filling connections 54 and 149 on the deck of the ship are closed with the covers, the loading hoses are secured in the superstructure.

2. All the pipe lines are filled with oil, circulating oil tanks Nos 1,2,3,4 are filled with oil according to Table No.2, the header box is completely filled with oil.

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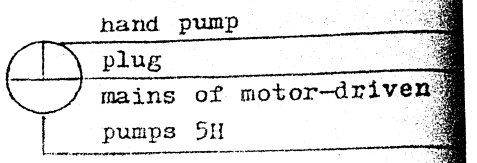
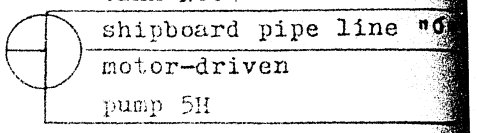
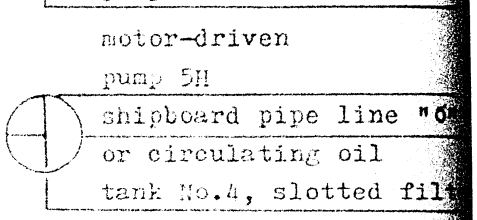
3. The three-way cocks (see Ref. Nos below) are in the following positions:

2, 5, 75, 76 – hand pumps are disconnected from motor-driven pumps 5H



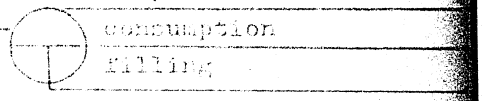


– shipboard pipe line " ", disconnected

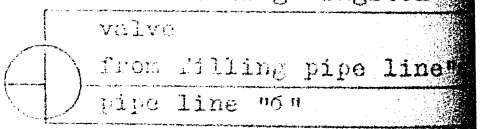


– delivery from pump 5H connected to the filter

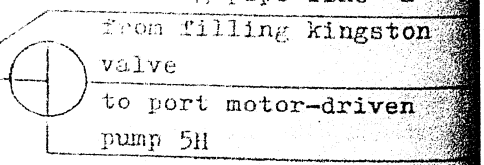
, 13, 14 – filling and [illegible] taken discon- [illegible] shipboard mains



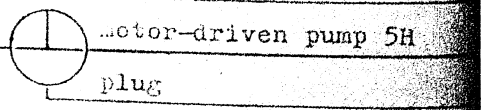
– filling mains "a", cut out



[illegible] disconnected from filling kingston valve



[illegible] – plug, cut out shipboard mains



4. Non-return shut-off valves 45 and 51 are in the NON - RETURN position.

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5. Cocks 1, 3, 81, 26, 30, 126 are open.

6. Cocks 34, 36 and 118 are sealed in the open position while cocks 37, 38, 39, 40, 114 and 116 are sealed in the shut off position.

The rest of the cocks, valves, kingston valves and the plugs are shut.

Note. When cocks 8, 144 and 158 are shut, their handles are removed.

(b) Taking Oil into Tanks

Caution. As a rule, oil shall be taken from the base under a pressure; pressure at the filling elbow shall be within 2 to 3 kgf/cm^2.

In case no loading means are available at the base, oil may be taken by gravity or with the aid of motor-driven pump 5H of compartmentV, port side.

In this case, prior to loading, oil shall be heated to a temperature of approximately 20°C.

Prior to taking oil into the tanks, unscrew the plugs from superstructure filling connections 54 and 149 and screw on filling elbows 56 and 151 with hoses 57 and 148 which, in their turn, are connected with the oil supply source if the oil is fed from the base under a pressure or if the oil is fed with the aid of port motor-driven pump 5H of compartment V. When oil is supplied by gravity, screw filling funnels 55 and 150 on the filling connections. Vent the filling pipe line "a" by opening cock 184.

When receiving oil from base under pressure

7. Open kingston valves 53, 152 and valves 52, 153.

8. Set three-way cock 145 to a position at which the oil can pass only from the filling kingston valve to filling pipe line "a".

Set three-way cock 146 to a position at which oil can pass to all three pipes.

9. When taking oil into clean oil tanks Nos 1, 2, 3 and 4, set three-way cocks 164, 180, 58 101 and 109 to the tank

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loading position (oil can flow from filling pipe line "a" o to free drainage to the tanks) and open vent valves 163, 17 60, 102, 47.

10. When taking oil into circulating oil tank No.1, op cook 8, non-return screw-down valve 25 and close cock 3.

11. When taking oil into circulating oil tank No.2, op cock 144, and set three-way cock 143 to the position at whi the pipe does not communicate with the tank, open non-retur screw-down valve 127.

12. When taking oil into circulating oil tank No.3, op cook 158, non-return screw-down valve 123 and close cook 1.

13. When taking oil into circulating oil tank No.4, op cook 73, non-return screw-down valve 72 and close cock 81.

14. When taking oil, use shall be made of:

(a) cocks 162, 166, 167, 175, 176, 178, liquidometers 100, 105 and the vent pipes with cocks 163, 179, 47, 60 and to check the filling of clean oil tanks Nos 1, 2, 3, 4;

(b) liquidometers 31, 119, 122 and 86 to check the fill of circulating oil tanks Nos 1, 2, 3 and 4.

The amount of oil taken into circulating oil tanks Nos 2, 3, 4 shall correspond to the values given in Table No.2 o these Instructions. After the required amount of oil has bee taken into the tanks, close the non-return screw-down valves

Caution! When filling the clean oil tanks, three-way cocks 58, 101, 109, 164, 180 are completely op until the following amounts of oil have been taken:

- to clean oil tank No.1 (port and starboard until oil starts escape from upper try cocks and 175;
- to clean oil tank No.2 - 4.5 m^3;
- to clean oil tank No.3 - 4.3 m^3;
- to clean oil tank No.4 - 2.5 m^3.

Upon receiving the above-mentioned amounts o oil, reduce oil supply by partially closing the three-way cocks to prevent back-pressure insid the tanks.

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In case oil escapes from the vent valve, use the respective three-way cock to shut the filling mains, and then shut the vent valve.

19. Filling over, set the cocks and valves of the oil pipe line to the initial position.

Caution! Check to see that cocks 8, 144 and 158 are closed, otherwise the oil may be pumped from the operating engine pipe line.

When receiving oil by port pump 5H of compartment V

20. Open valve 152 and valve 153.

21. Set three-way cock 141 to the position to disconnect the pipe line "B".

22. Open cock 144, the respective valve of three-valve manifold 171 and valve 151.

23. Set three-way cock 161 to the position to disconnect the pipe running to the loading kingston valve.

24. When taking oil into clean oil tanks Nos 1, 2, 3, 4, set four-way cocks 138, 140, 98, 101, 109 to the tank filling position and open vent valves 139, 179, 47, 60 and 102.

25. When receiving oil into circulating oil tanks Nos 1, 2, 3, 4, open cocks 16, 32, 73, 137 and non-return screw-down valve 74.

26. Start motor-driven pump 5H, perform the procedure outlined under Item 14 of these Instructions (See CAUTION! to Item 14).

27. Loading of oil over, stop pump 5H and set the cocks and valves of the pipe line to the initial position.

When receiving oil by gravity

28. Perform the procedures outlined under Items 7, 8, 9, 10, 11, 12, 13 and 14 of these Instructions.

Caution! In case clogging occurs when receiving the oil by gravity, clean meshes of funnels 55 and 150.

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25. Oil loading is over, set the cocks and valves of the pipe line to the initial position.

In case oil is to be filled into a part of the tanks, o the valves and the cocks of the respective tanks.

Note: Used oil from the tanks shall be removed through filling kingston valve 152 of compartment V by po pump 5K of the same compartment along the hoses c nected to plug-nuts 24, 84, 121 and 128 provided the circulating oil tanks to the plug-nut of thre -way cock 143 at the pump suction side and to the plug-nuts of cocks 157 and 154 arranged at the di charge side. When performing this procedure, see that three-way cocks 145 and 146 shall be in t position at which the pipes are disconnected from filling kingston valve.

(c) Transferring Oil from Oil Tanks to Base or to Ship by Port Pump 5K of Compartment V

26. Remove the plug from filling connection 149 and scr on filling valve 151 with hose 146. Connect the hose with the oil supply source.

27. Open kingston valve 152, valves 153, 161, cock 144 a the respective valve of three-valve manifold 171. Make sure three-way cocks 143, 145 and 146 are in the initial posi tion.

28. When transferring oil from eleven oil tanks Nos 1, 2, 3, 4, set three-way cocks 164, 130, 109, 55, 101 to the posi-tion at which non-return intake valves 165, 131, 111, 61, 99 communicate only with filling line "a". Open vent valves 163, 17%, 4", 10 and 102.

29. When transferring oil from circulating oil tank No. open cock 6, set non-return screw-down valve 35 to the NO RETURN position and close cock 3.

30. When transferring the oil from circulating oil tank No.2, set non-return screw-down valve 127 to the NO RETURN po sition.

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31. When transferring oil from circulating oil tank No.3, open cock 156, set non-return screw-down valve 123 to the NO RETURN position and close cock 1.

32. Start motor-driven pump 5H.

33. When transferring oil, watch the liquidometers to know the amount of oil in the tanks. As soon as the tanks are empty, stop the pump.

Set the cocks and valves of the pipe line to the initial position.

Note. If water oil is to be pumped out from a part of the [illegible] open the valves and the cocks of the tanks to be emptied.

Note 2. If the pump of compartment V fails to transfer oil at a temperature below 20°C from the tanks of compartment VI, use motor-driven pump 5H of compartment VI for which purpose set three-way cocks 73 and 74 to the position which allows the oil to flow from motor-driven pump 5H only to oil pipe line "6"; open cocks 35 and 73, valve 153 and kingston valve 152.

Set three-way cocks 58 and 101 to the position at which non-return intake valves 61 and 99 are connected only with the loading oil pipe line "a"; set non-return screw-down valve 72 to the NO RETURN position. The rest of the valves and the cocks shall be in the initial position.

(d) Transferring Oil from Clean Oil Tanks to Circulating Oil Tanks

Replenishing oil into circulating oil tank No.1 by starboard motor-driven pump 5H

34. Open cock 8, the respective valve on three-valve manifold 171, valve 161 and cock 27.

35. When transferring oil from clean oil tank No.1:

(a) when transferring oil from the port tank, set three-way cock 164 to the CONSUMPTION FROM TANK position (in this case

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non-return intake valve 165 communicates with loading pipe line "a"), open vent valve 163;

(b) when transferring oil from the starboard tank, set three-way cock 180 to the CONSUMPTION FROM TANK position, op vent valve 179.

Note. See to it that the oil be consumed evenly from th port and starboard portions of clean oil tank No. For which purpose watch try cocks 162, 166, 167, 175, 176 and 178. To discharge oil from funnels t collecting oil tank, it is necessary to open cock 182 and 183. After the oil has been discharged, close cocks 182 and 183.

36. When transferring oil from clean oil tank No.2, set three-way cock 109 to the CONSUMPTION FROM TANK position, op vent valve 47.

37. When transferring oil from clean oil tank No.3, set three-way cock 58 to the CONSUMPTION FROM TANK position, ope vent valve 60.

38. When transferring oil from clean oil tank No.4, set three-way cock [illegible] CONSUMPTION FROM TANK position, ope vent valve 102.

39. Start motor-driven pump 5H.

40. When transferring oil, watch the liquidometer to che filling of the tank. The amount of oil taken into the tank sh correspond to the values given in Table 2 of these Instructio

41. After the tank has been filled, stop the pump. Set t cocks and valves of the pipe line to the initial position. Ma sure that cock 8 is shut.

Replenishing oil into circulating oil tank No.2 by port motor-driven pump 5H

42. Open cock 144, the respective valve of three-valve manifold 171, valve 161 and cock 137.

43. Perform the procedures outlined under Items 35, 36, 38, 39, 40.

44. After filling the tank, stop the pump.

Set the cocks and valves of the pipe line to the initial position. Make sure that cock 144 is closed.

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Replenishing oil into circulating oil tank No.3 by motor-driven pump 5H of the centre engine

45. Open cock 158, the respective valve on three-valve manifold 171, valve 161 and cock 16.

46. Perform the procedures outlined under Items 35, 36, 37, 38, 39, 40.

47. After filling the tanks, stop the pump. Set the cocks and valves of the pipe to the initial position. Make sure that cock 158 is shut.

Replenishing oil into circulating oil tank No.4 by motor-driven pump 5 of compartment VI

48. Open cock 73, set three-way cock 74 to the position at which the slotted filter is disconnected.

49. Set three-way cock 71 to the position at which the total oil pipe line "6" is disconnected.

50. Perform the procedures outlined under Items 35, 36, 37, 38, 39, 40.

51. After filling the tank, stop the pump. Set the cocks and valves of the pipe line to the initial position.

Caution! To replenish oil into circulating oil tanks Nos 1, 2, 3, disconnect pump 5H from the diesel-engine priming pipe lines. Therefore, to avoid damage, perform these procedures after the respective diesel-engine has been stopped.

(e) Priming the Diesel-Engines

Priming the starboard diesel-engine and the air distributor of the fore pneumatic clutch from the crankcase before starting and after stopping

52. Open cocks 72, 177 and valve 61.

53. Start starboard motor-driven pump 5H of compartment V. For duration of priming see the "Diesel-Engines 2D42, Service Manual"

54. Priming over, stop the pump.

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Priming the port diesel-engine and the air distributor of the fore pneumatic clutch from the crankcase before starting and after stopping

55. Open cocks 133, 147 and valve 112.

56. Start port motor-driven pump 5H.

57. Priming over, stop the pump.

Priming the centre diesel-engine and the air distributor of the fore pneumatic clutch from the crankcase before starting and after stopping

58. Open cocks 130, 141, 49 and valve 45.

59. Start motor-driven pump 5H of the centre diesel-engine.

60. Priming over, stop the pump.

Caution: When priming the diesel-engine, provided one or two engines are already in operation, make sure that cocks 134, 6 and 144 are closed, otherwise the oil system of the engine in operation is likely to get empty, thus causing damage.

Priming the starboard diesel-engine from circulating oil tank No.1

61. Set non-return screw-down valve 25 to the NO RETURN position; open cock 177 and valve 41.

62. Perform the procedures outlined in Items 53 and 54 of these Instructions.

Priming the port diesel-engine from circulating oil tank No.2

63. Set non-return screw-down valve 127 to the NO RETURN position; open cock 147 and valve 112.

64. Perform the procedures outlined in Items 56 and 57 of these Instructions.

Priming the centre diesel-engine from circulating oil tank No.2

65. Set non-return screw-down valve 103 to the NO RETURN position; open cocks 141, 49 and valve 45.

66. Perform the procedures outlined in Items 59 and 60 of these Instructions.

Priming the starboard diesel-engine from the gravity tank No.2 [illegible] oil is supplied in the oil pressure system to cocks 134, 177, 178.

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68. Open the respective valves on three-valve manifolds 6, 71, and valve 161.

[illegible] start motor-driven pump 5H and switch on the electri-[illegible].

[illegible] priming the diesel-engine, use valve 161 to [illegible] flow of oil fed to the oil preheater. In doing [illegible] pressure gauges 169, 170 and be sure that the [illegible] not exceed 4 kgf/cm².

[illegible] periodically read off pressure gauges 169 [illegible] indicates that oil passes through the oil [illegible].

[illegible] the temperature of oil reaches 25°C as indicated [illegible], 73, 74, stop the priming. Stop the pump [illegible] the valves of the pipe line to the initial [illegible].

[illegible] the diesel-engine from the crankcase by port [illegible] oil preheated in the oil preheater [illegible], 130 and 174.

[illegible] the procedures outlined in Items 68, 69, 70 [illegible].

[illegible] the centre diesel-engine from the crankcase by centre diesel-engine motor-driven pump 5H with oil preheated in the oil preheater

74. Open valves 130, 168 and 174.

75. Perform the procedures outlined in Items 68, 69, 70 and 71.

[illegible] Preheating the Oil in the Diesel-Engine Circulating Oil Tanks

[illegible] the oil in circulating oil tank No.1 of the [illegible]

[illegible] the two-return screw-down valve 25 to the NO RETURN [illegible] and open tank 77.

[illegible] valves 168, 169, valve 161 and the respective valve [illegible] manifold 171.

[illegible] the centrifugal pump 5H and switch on the oil [illegible].

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79. When preheating oil, use valve 161 to adjust the pressure of oil fed to oil preheater. The pressure should not exceed 4 kgf/cm^2 as read off pressure gauges 169, 170; use the distant-reading thermometer to watch the temperature of oil in the tank.

80. After the temperature of oil in the tank has reached 40-45°C, switch off the oil preheater, stop the pump and set all the cocks and valves of the pipe line to the initial position.

Note. Check the temperature of oil in the tank by an indicating instrument seated in the diesel-engine control station.

Preheating the oil in circulating oil tank No.2 of the port diesel-engine

81. Set non-return screw-down valve 127 to the NO RETURN position and open cock 137.

82. Perform the procedures outlined in Items 77, 78, 79 and 80.

Preheating the oil in circulating oil tank No.3 of the centre diesel engine

83. Set non-return screw-down valve 123 to the NO RETURN position and open cock 16.

84. Perform the procedures outlined in Items 77, 78, 79 and 80.

Caution! Prior to starting the diesel-engines at a temperature of oil in the circulating oil tanks below 20°C, preheat the oil by pumping it through the oil preheater. If the temperature of oil in the crankcases is below 20°C, first prime the diesel-engines with preheated oil.

Note. Preheating the oil in the circulating oil tanks and priming the diesel-engines with preheated oil may be effected in turn only.

(g) Preparing the Shafting Lube Oil System for Operation of the Main Diesel-Engines and Propulsion Motors

To operate the starboard diesel-engines for running

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85. Set non-return screw-down valve 72 to the NO RETURN position, open valves 69, 65 and cocks 85, 67.

86. Make sure that cock 73 is in the shut, while valve 41 is in the open positions.

87. Start motor-driven pump 5H of compartment VI.

88. Use valves 65 and 69 to adjust the pressure of oil to the air distributor and to the thrust bearing. See the pressure readings of gauges 62 and 63 respectively. The pressure should not exceed:

2.0 kgf/cm^2 for the air distributor;

0.5 kgf/cm^2 for the thrust bearing.

89. After stopping the diesel-engine, stop the pump. Set the cocks and valves of the pipe line to the initial position.

To operate the port diesel-engine for running:

90. Set non-return screw-down valve 72 to the NO RETURN position, open valves 88, 97 and cocks 85, 89.

91. Make sure that cock 73 is in the shut, while valve 112 is in the open positions.

92. Start motor-driven pump 5H of compartment VI.

93. Use valves 97 and 88 to adjust the pressure of oil to the air distributor and to the thrust bearing. See the pressure readings of gauges 96 and 94 respectively. The pressure should not exceed:

2.0 kgf/cm^2 for the air distributor;

0.5 kgf/cm^2 for the thrust bearing.

94. After stopping the diesel-engine, stop the pump. Set the cocks and valves of the pipe line to the initial position.

To operate the centre diesel-engine for running:

95. Set non-return screw-down valve 72 to the NO RETURN position, open valves 70, 98 and cocks 85, 90.

96. Make sure that valve 45 and cock 49 are in the open, while cocks 73 and 103 are in the shut position.

97. Start motor-driven pump 5H of compartment VI.

98. Use valves 98 and 70 to adjust the pressure of oil to the air distributor and to the thrust bearing, for which purpose see the pressure readings of gauges 93 and 87 respectively. The pressure should not exceed:

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2.0 kgf/cm^2 to the air distributor;
0.5 kgf/cm^2 to the thrust bearing.

99. After stopping the diesel-engine, stop the pump. Se
the cocks and valves of the pipe line to the initial positio

Caution! Start feeding the sea water to the oil cooler
compartment VI only after the temperature of o
in the thrust bearing reaches 40-45°C. Permis-
sible temperature of oil in the bearings of th
shaftings is 65°C.

To operate the starboard propulsion motor, do the follo
100. Perform the procedures outlined in Items 85, 86,
86.

Note. With the port and starboard main propulsion motor
in operation, do not check valves 41 and 112 feed-
ing the oil to the fore air distributors.

101. After stopping the propulsion motor, stop the pum
Set the cocks and valves of the pipe line to the initi
position.

To change operation of the port propulsion motor, do
following:

102. Perform the procedures outlined in Items 90, 91,
93 (See Note to Item 103).

103. After stopping the propulsion motor, stop the pu
Set the cocks and valves of the pipe line to the ini
position.

To operate the auxiliary motor, do the follo
the valve 4 and check that the valve 3 is
open.

Perform the procedures outlined in Items 95, 96
the valves 3 and 4 are open and the pressure
the air bottles is not less than 50 kgf/cm^2.

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Note. In case motor-driven pump 5H of compartment VI gets defective and it cannot be duplicated by one of motor-driven pumps 5H of compartment V, the diesel-engines and the main propulsion motors may operate at small loads without delivering the oil to the thrust bearings. In this case, sea water should be supplied to the thrust bearing cooling coils and the required levels of oil shall be obtained on the bearings by the oil gauge glasses; lubrication being performed from the header box to the oil distributors by opening cocks 83, 103 and valves 96, 97, 98 and 51.

[illegible] propulsion motor, proceed as follows:

[illegible] valve 72.

[illegible] the required level of oil on the [illegible] the oil gauge glass; watch the level of [illegible], if necessary.

[illegible] of oil in the header box and if necessary, replenish [illegible] from circulating oil tank No.4 with the help of [illegible] pump.

[illegible] propulsion motor, set the cocks and valves [illegible] to the initial position.

[illegible] the oil header box

[illegible] valve 72 to the NO RETURN position, open cock 83, set three-way cocks 75 and 76 to the position [illegible] are disconnected.

[illegible] pump for filling the header box, [illegible] the oil header box to check the level [illegible].

[illegible] the header box, set the cocks and valves [illegible] to the initial position.

[illegible] shall be filled with oil when [illegible] [illegible] Oil Burning Installation [illegible] [illegible] pumps [illegible].

[illegible] [illegible] [illegible] [

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114. Open cock 22, the respective valve of three-valve manifold 171, valve 161 and cock 27.

115. Start starboard motor-driven pump 5H.

116. After draining the crankcase, stop the pump. Set the cocks and valves of the pipe line to the initial position.

To drain the crankcase of the port diesel-engine, proceed as follows:

117. Open cock 133, the respective valve of three-valve manifold 171, valve 161 and cock 137.

118. Start port motor-driven pump 5H.

119. After draining the crankcase, stop the pump.

[illegible] the cocks and valves of the pipe line to the initial position.

To drain the crankcase of the centre diesel-engine, do as follows:

[illegible] open cock 134, the respective valve of three-valve manifold 171, valve 161 and cock 16.

[illegible] start motor-driven pump 5H of the centre diesel-engine.

[illegible] after draining the crankcase, stop the pump.

[illegible] the cocks and valves of the pipe line to the initial position.

7. PRECAUTIONS DURING OPERATION AND STOPPING

[illegible] that the lube oil system is in operation, watch the pressure and the quantity of oil. For this purpose use the [illegible] gauges, the thermometers, the [illegible] control instruments and the [illegible] installed [illegible] the lubricating points.

[illegible] the crankcase shall not exceed the [illegible] valves given in the respective instruction [illegible] [illegible]

[illegible]

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D. MAINTENANCE DURING PROTRACTED STANDSTILL PERIOD

(a) Protracted Standstill

Protracted standstill period assumes anchorage of the submarine during running and medium repair or when the submarine is out of commission.

In case of protracted shut-down period, do the following:

1. Drain oil from the pipe lines of the lube oil system.
2. Pump out used and clean oil from the tanks to the base.
3. Grease the Kingston valves, all the valves and cocks.
4. Clean dirt from all the tanks.
5. Clean filters and strainers and fill the system with clean oil.

(b) Disassembly and Reassembly

1. When disassembling and reassembling the oil pipe lines, see to it that foreign matter might get into the pipes.

To prevent foreign matter from getting into the pipes, close the ends of disconnected pipes with wooden or metal plugs. Never use rags or waste to stop the pipes since they are likely to get into the pipes.

2. For disassembly and reassembly of the pipe lines, use only standard tools.

3. The size, types and material of the new pipes and fittings mounted in the course of repair must correspond to those of the replaced pipes.

4. Every time after repairing of the pipe lines or their separate sections, test them for tightness.

E. GRADING AND NUMBERS

	Grades	Remarks

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5. Inspect the hand-operated pumps and check them in operation.

III. Monthly Inspection

Perform all the procedures of daily and weekly inspections and, beside that, do the following:

6. Check condition and securing of the bellows-type expansion pieces, flanged joints, pipe lines and drain plugs.

7. Disassemble the valve manifolds of the hand-operated pumps, inspect the valves and the springs, eliminate troubles, if any.

IV. Inspection during [illegible] Repair of the Ship

Perform all the procedures of daily, weekly and monthly inspections [illegible] the following:

8. Proceed [illegible] the technical condition, disassemble, inspect and lap [illegible] shut-off valves.

9. Test the [illegible] oil pipe lines for tightness.

10. Clean and test [illegible] oil and circulating oil tanks for tightness.

11. Open and inspect the oil coolers for condition. Clean and test the oil tubes for tightness and strength at a hydraulic pressure. Replace the [illegible] tubes.

12. Proceed [illegible] condition, inspect and repair the [illegible] and [illegible] scraping the piston rings, valves, [illegible].

[illegible]

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[redacted]

[redacted] gauges for sound

7. REFERENCE DATA

For maintenance of the lube oil system, use the respective instructions for the following articles:

1. [redacted] Diesel-Engine.
2. Shaftings.
3. Pneumatic Clutches 8HMC.
4. Oil Preheater HMO-500.
5. Sea Water Cooling Line of Diesel-Engine Gas Exhaust System, Coolers and Shaftings.
6. Automatic Remote Control System of [redacted] Diesel-Engine.
7. Direct-Acting Temperature Regulator [redacted]
8. Oil Coolers MO 2.4.
9. Oil Cooler MXH-[redacted]

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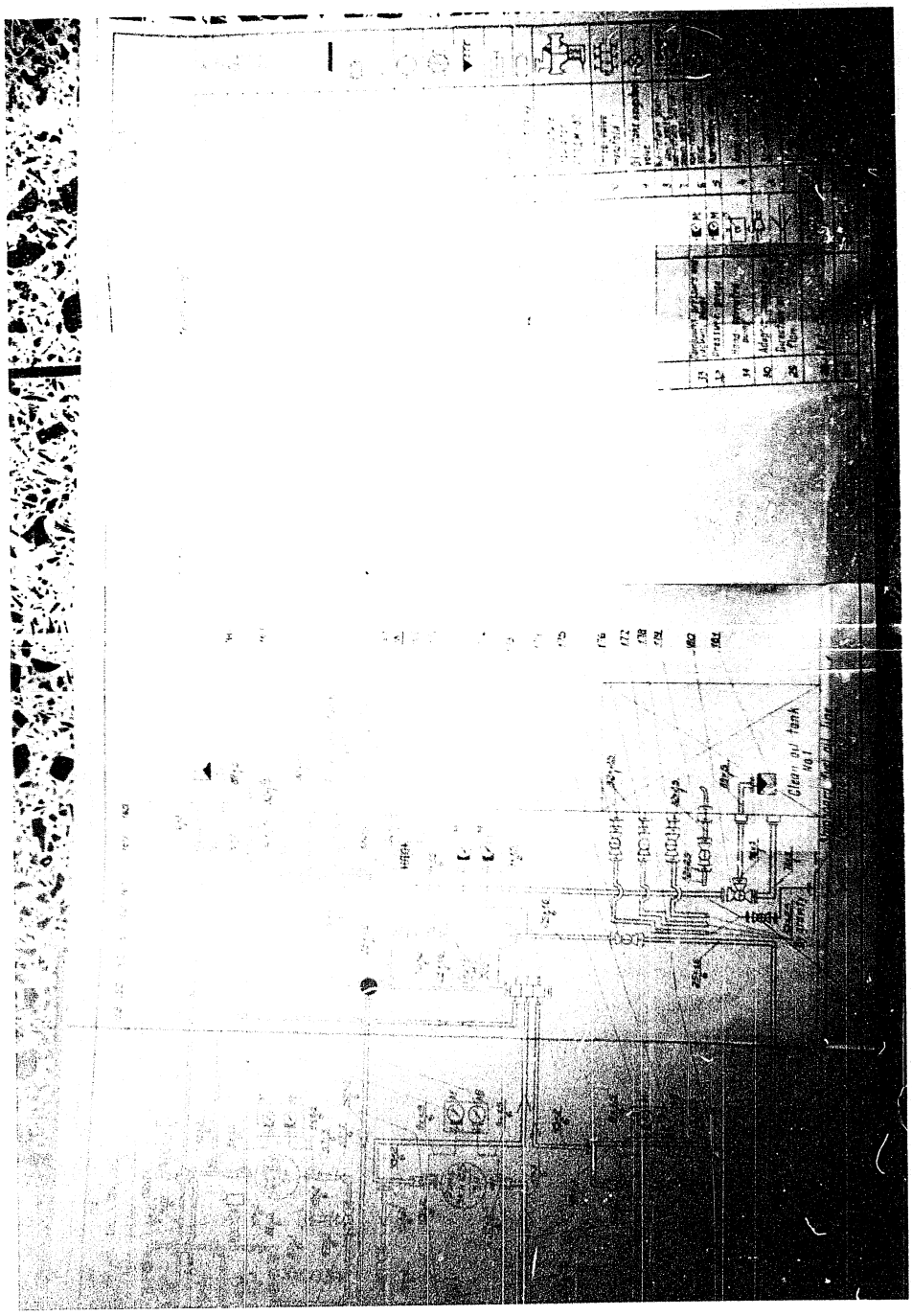

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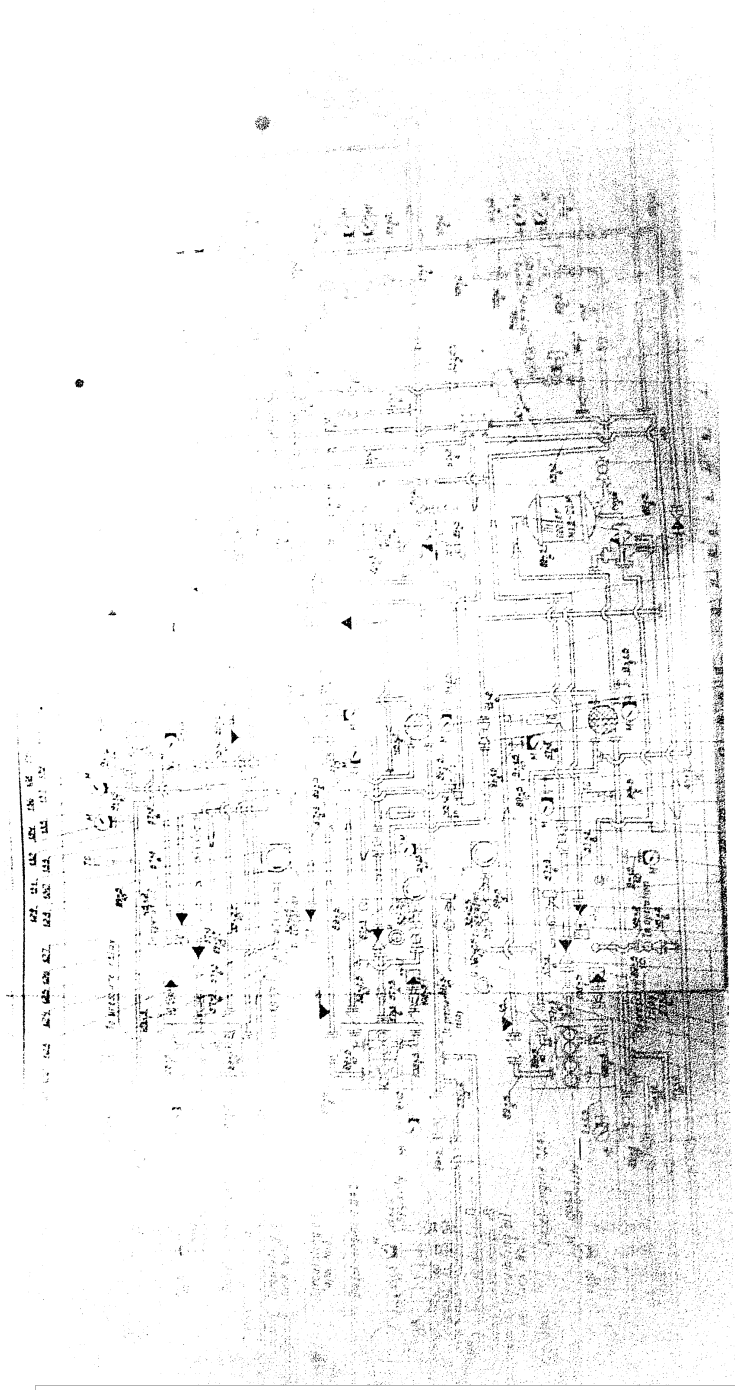

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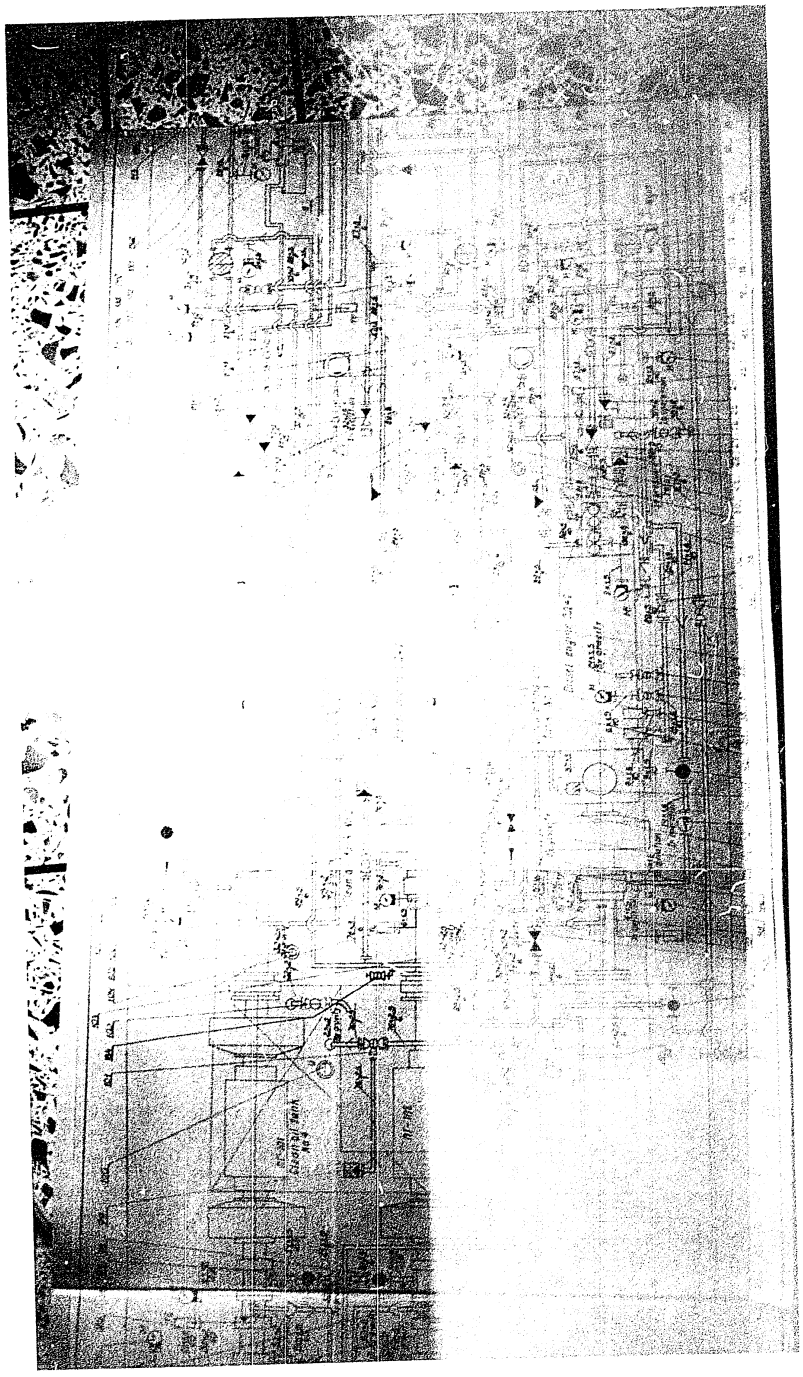

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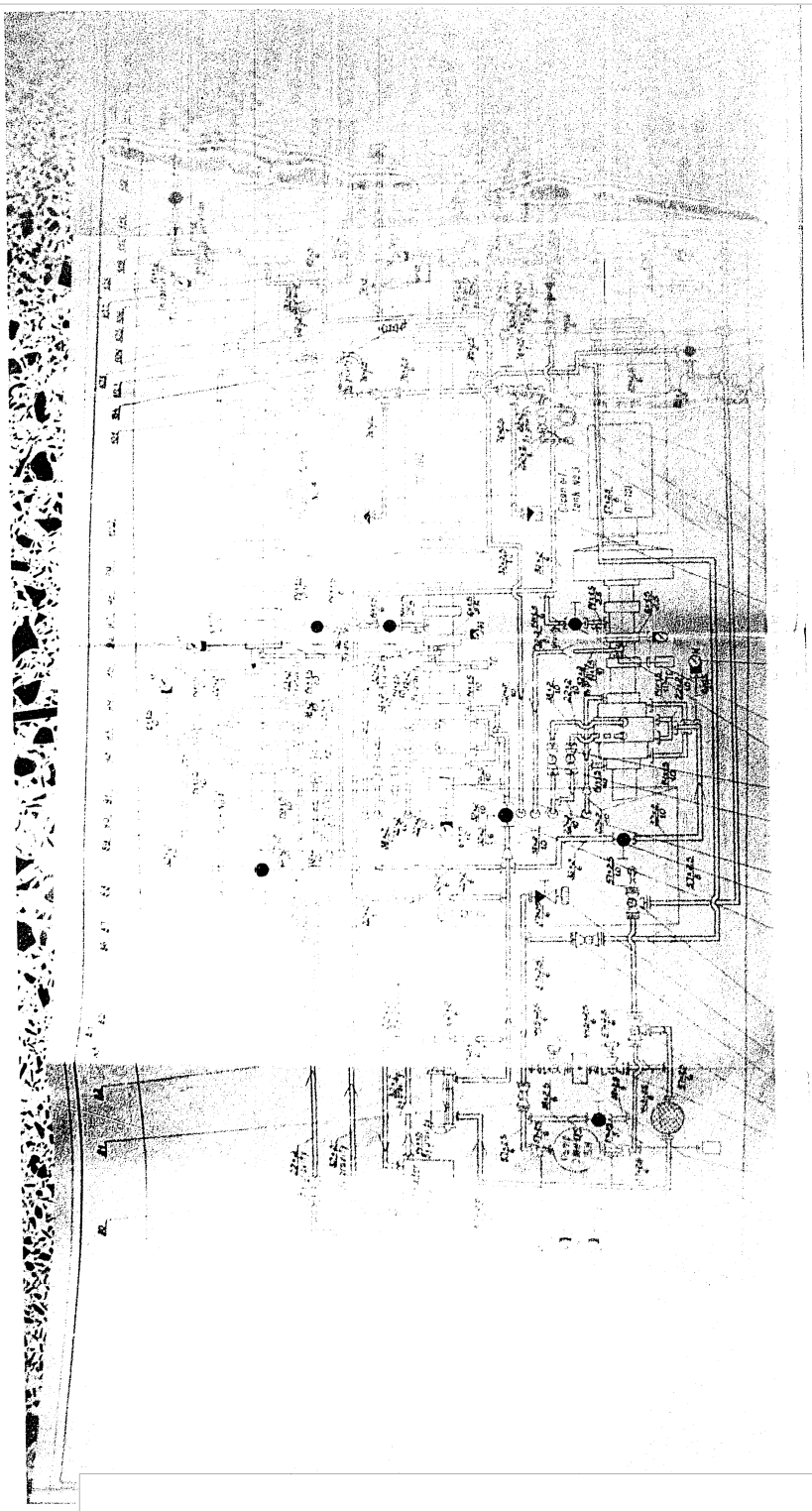

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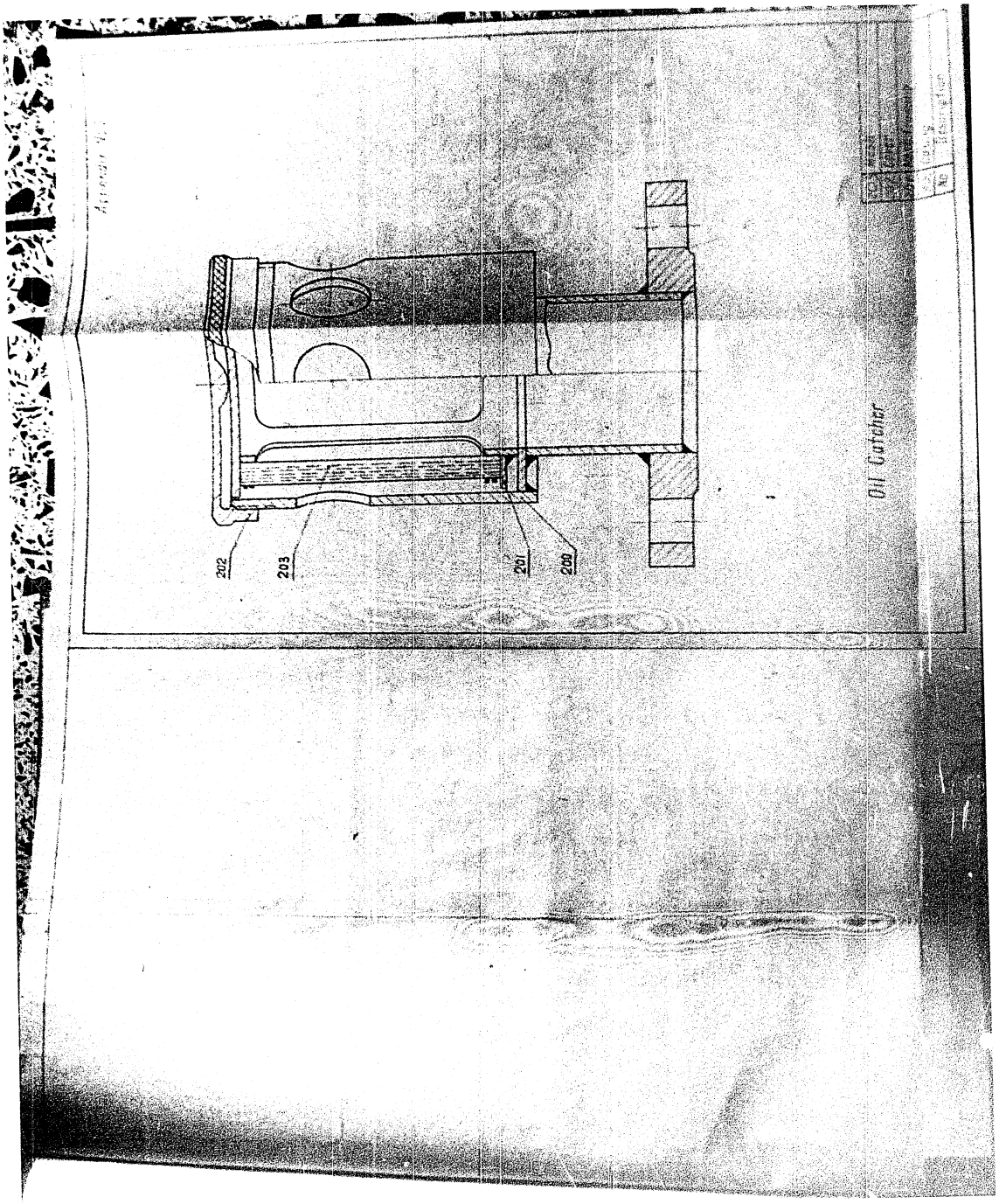

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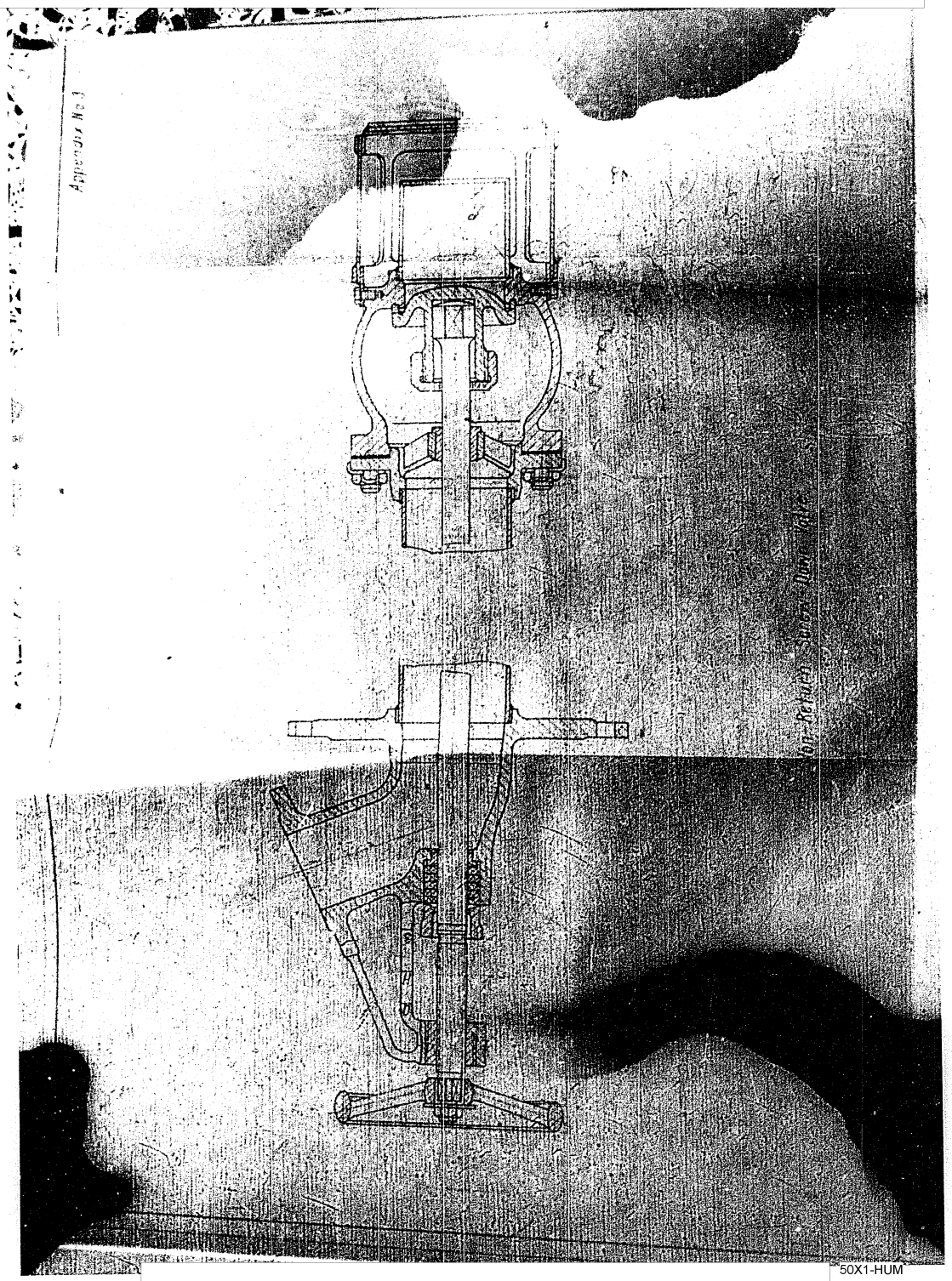

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F. Preventive Maintenance and Repairs .....
[illegible]nce Data .....

1. Diesel-Engine and Shafting Oil System Diagram
2. Oil Catcher
3. Non-Return Screw-Down Valve

50X1-HUM

Sanitized Copy Approved for Release 2011/08/04 : CIA-RDP82-00038R002100100001-8